MARCH 7, 1958

electronics

business edition

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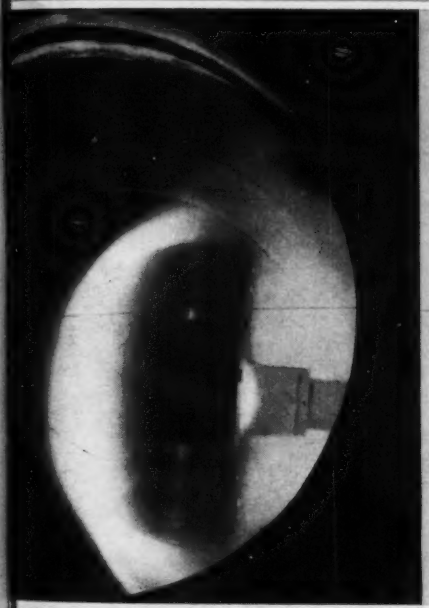

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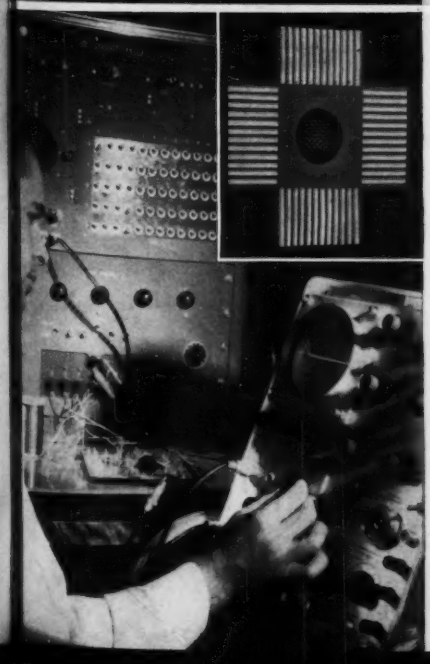

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A McGRAW-HILL PUBLICATION • VOL. 31, NO. 10 • MAR. 7, 1958

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"THREE DEGREES BELOW ZERO"

As a man who has steadily shunned all degrees except honorary ones (I'm still waiting for somebody to speak up) I feel well qualified to discuss the subject. And even though I myself am a prominent scientist—Sec'y.-Treas. of the Lower Bronx Astronautical Society—I must admit I don't think degrees are very important. Of course, my viewpoint might change. Especially if I can wheedle some college into awarding me a Ph.D. (Phenomenal Droodlist). Ah, well, who can tell what the future will bring?

One thing the future is sure to bring is the increasing use throughout industry of the J&L Optical Comparator. This is an ingenious instrument which measures and inspects all sorts of parts and objects laterally, vertically and angularly—it also inspects by reflection, by tracing and from overhead—with speed and precision (to .0001").

The photo above shows how a J & L Comparator is used by National Seal Division of Federal-Mogul-Bower Bearings, Inc., Redwood City, Calif., to inspect and measure high precision rubber moldings. Due to the flexibility and shrinkage of the parts, accurate measurement can be made only by means of the Comparator. Using reflected light, the Comparator visualizes the actual manufacturing process. That is, the cross section inspection at 20X of the moldings themselves. Based on this inspection, the molds are approved. Periodically, as a check, production parts are measured and compared in contour to the same chart outline. Thus the Comparator acts as a monitor, and reduces scrap before it starts.

Jones & Lamson makes the Comparator in eleven models, ranging from a 7" Bench type to a 30" floor model. For complete details, send this coupon *today*.

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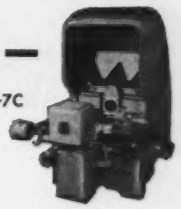

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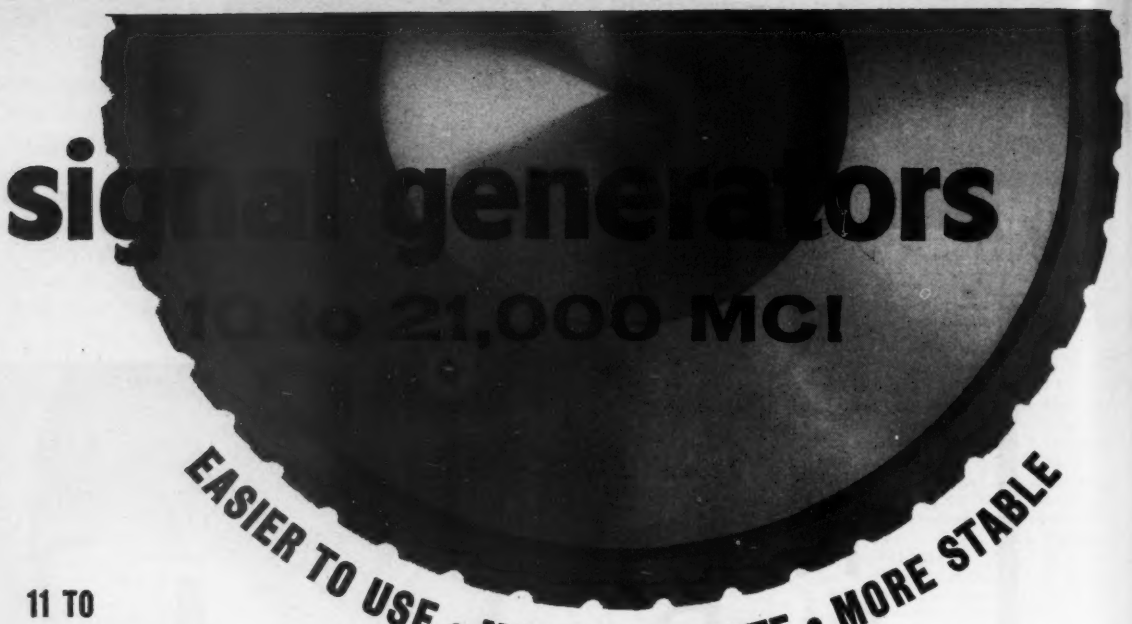

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With *-hp-* signal generators, frequencies are directly set and read on one dial. Output voltage is directly set and read. No calibration charts are required. Most *-hp-* generators offer internal pulse, FM or square wave modulation; some include external pulsing and FM'ing. New *-hp-* 626A (10 to 15.5 KMC) and 628A (15 to 21 KMC) offer 10 mw output, SWR 1.2.

-hp- signal generators outsell other signal sources by approximately 2:1. Engineers report the reasons are simpler operation, versatility, trouble-free performance, and exceptional value.

Instrument	Frequency Range	Characteristics	Price
-*hp*- 608C	10 to 480 MC	Output 0.1 μv to 1 v into 50 ohm load. CW, pulse or AM mod. Direct calibration.	$ 950.00
-*hp*- 608D	10 to 420 MC	Output 0.1 μv to 0.5 v into 50 ohm load. CW, pulse or AM mod. Direct calibration and crystal calibrator check	1,050.00
-*hp*- 612A	450 to 1,230 MC	Output 0.1 μv to 0.5 v into 50 ohm load. Pulse, CW or amplitude modulation to 5 MC Direct calibration.	1,200.00
-*hp*- 614A	800 to 2,100 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration.	1,950.00
-*hp*- 616A	1,800 to 4,000 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration.	1,950.00
-*hp*- 618B	3,800 to 7,600 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration.	2,250.00
-*hp*- 620A	7,000 to 11,000 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration.	2,250.00
-*hp*- 623B	5,925 to 6,575 MC; 6,575 to 7,175 MC; 7,175 to 7,725 MC	Output 70 μv to 0.223 v into 50 ohm load. FM or square wave modulation. Separate power meter and wave meter section.	1,900.00
-*hp*- 624C	8,500 to 10,000 MC	Output 3.0 μv to 0.223 v into 50 ohm load. Pulse, FM or square wave modulation. Separate power meter and wave meter section.	2,265.00
-*hp*- 626A	10,000 to 15,500 MC	Output 1 $\mu\mu$watt to 10 mw. Internal or external pulse, FM, or square wave modulation. Direct calibration.	3,250.00
-*hp*- 628A	15,000 to 21,000 MC	Output 1 $\mu\mu$watt to 10 mw. Internal or external pulse, FM, or square wave modulation. Direct calibration.	3,000.00

Your -hp- field engineer has complete data on all -hp- generators. Or, write direct.

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Raising New Money

$300 million of new capital raised by 32 firms in last six months of 1957. Private placements mount

ELECTRONICS FIRMS raised almost as much new capital in the last half of 1957 as in the first half, despite a falling stock market since July.

Three hundred million dollars was raised by 32 firms from July to December, compared with $327 million raised by 30 firms from January to June, according to Investment Dealers' Digest.

Private placements increased sharply in the last six months period. Some $88 million, or 30 percent of the total, came from private placements in the July-December period. In the first six months private placements amounted to $27 million, or eight percent of the total.

Privately placed securities are sold directly to a few large investors, not offered for general sale to the public.

PUBLIC SECURITY ISSUES JULY–DEC. 1957

Company	Value	Description	Underwriter or Lender	Sales Cost
Amphenol Electronics	$5,500,000	200,000 shs common @ 27½	Hornblower & Weeks	6.4%
Electro Instruments	625,000	50,000 shs common @ 12½	Bear, Stearns	10.0%
Electronic Res. Assocs.	300,000	100,000 shs class A com. @ 3	Singer, Bean & Mackie	15.0%
Emerson Electric	3,390,000	5½% 20 yr conv. sub. debentures	Smith, Barney	1.5–2.5%
Epsco	960,000	60,000 shs common @ 16	W. C. Langley	9.4%
General Tire & Rubber	12,000,000	6% 25 yr sub. debs. w. warrants	Kidder, Peabody	1.87½%
Haydu Electronics	300,000	100,000 shs common @ 3	Berry & Co.	15.0%
Hycon Manufacturing	1,200,000	400,000 shs common @ 3	Dempsey-Tegeler	10.0%
Minneapolis-Honeywell	28,155,145	331,237 shs common @ 85	Eastman Dillon	1.3–3.4%
Narda Microwave	270,000	90,000 shs common @ 3	Milton D. Blauner	12.5%
Perkin-Elmer	1,500,000	75,000 shs common @ 20	Blyth & Co.	7.0%
Sanders Associates	1,500,000	100,000 shs class A com. @ 15	Kidder, Peabody	8.0%
Siegler Corp.	4,800,000	320,000 shs common @ 15	William R. Staats	7.0%
Smith-Corona	4,235,700	6% 20 yr conv. sub. debs.	Lehman Brothers	2.5%
Sperry-Rand	110,000,000	5½% 25 yr debs. w. warrants	Lehman Brothers	1.15%
Statham Instruments	1,250,000	100,000 shs common @ 12½	Blyth & Co.	8.0%
Thompson Products	19,729,500	4⅞% 25 yr conv. sub. debs.	Smith Barney	1.1–1.9%
Tracerlab	675,966	112,661 shs common @ 6	Lee Higginson	.....
Tung-Sol Electric	5,000,000	100,000 shs conv. 5% pfd. @ 50	Harriman, Ripley	3.5%
Victoreen Instrument	700,000	6% 10 yr conv. sub. debs.	Saunders, Stiver	2.0–5.5%

PRIVATELY PLACED SECURITIES JULY–DEC. 1957

Aeroquip Corp.	$1,000,000	5½% 10 yr notes	Prudential Insurance
Aircraft Radio	1,600,000	5½% 15 yr notes w. warrants	Prudential Insurance
AMF Pinspotters	20,000,000	5% 5 yr notes	Prudential & 1 other
" "	40,000,000	5¾% 15 yr notes	" "
Audio Devices	App. 1,000,000	100,000 shs com. w. warrants	Carl M. Loeb, Rhoades & Co.
Cook Electric	2,000,000	5¾% 10 yr notes	Mass. Mutual Life (Blunt Ellis & Simmons)
Dictaphone Corp.	4,000,000	5¼% 20 yr notes	Mutual of N.Y. & others
Monroe Calculating	2,500,000	5% 10 yr sub. notes	Mass. Mutual Life
Perkin-Elmer	2,000,000	5⅜ 15 yr notes	Prudential Insurance
Rome Cable	5,000,000	4¼–4¾% 5–15 yr notes	Conn. Mutual Life & Mass. M. L.
Siegler Corp.	3,000,000	5½% 12 yr notes	New England Mutual Life (Wm. R. Staats)
Tung-Sol Electric	5,000,000	5¼% 10 yr notes	Prudential Insurance
Varo Manufacturing	1,000,000	6% 10 yr notes	Guardian Life (Shearson Hamill)

SHARES and PRICES

ACCORDING to the Air Force, the four contractors listed below are participating in construction of an early warning system for detection of missiles. Ultimate cost will be about $721 million. Initial funds, included in the President's supplemental budget requests, have already been approved. RCA is the prime contractor.

Some Missile Detection System Contractors	Recent Price	Indicated Dividend Rate	Percent Yield	Earned Per Common Share 1957	Period	1956	Traded	1957–1958 Price Range
RCA	33½	1.50	4.5	1.87	(9 mos)	1.82	NYSE	27 –40
General Electric	60¾	2.00	3.3	2.10	(9 mos)	1.85	NYSE	52⅜–72⅜
Goodyear Tire	70	2.40[1]	3.4	6.12	(yr)	5.90	NYSE	69 –95¼
Sylvania	36⅛	2.00	5.5	2.37	(9 mos)	3.20	NYSE	29¼–46¼

[1] plus stock

MERGERS, ACQUISITIONS and FINANCE

• **High Voltage Engineering,** Burlington, Mass., manufacturer of particle accelerators, acquires controlling interest in **Electronized Chemicals** of New York City. EC has U. S. and foreign patents in electron processing which supplement HV patents in same field. John M. McCarthy, vice president and comptroller of High Voltage, becomes president of its new subsidiary. The acquisition is expected to strengthen High Voltage's position in radiation equipment for processing chemical materials and for sterilizing surgicals, drugs and food.

• **General Transistor,** Jamaica, N. Y., purchases the former **Dunn Worsted** plant in Woonsocket, R. I., which will be used for production of newly developed semiconductor products. The R.I. plant is expected to employ 500 people this year, 1,000-2,000 eventually. GT now employs 500 people in four Long Island plants. The new products will probably include silicon and germanium diodes and rectifiers.

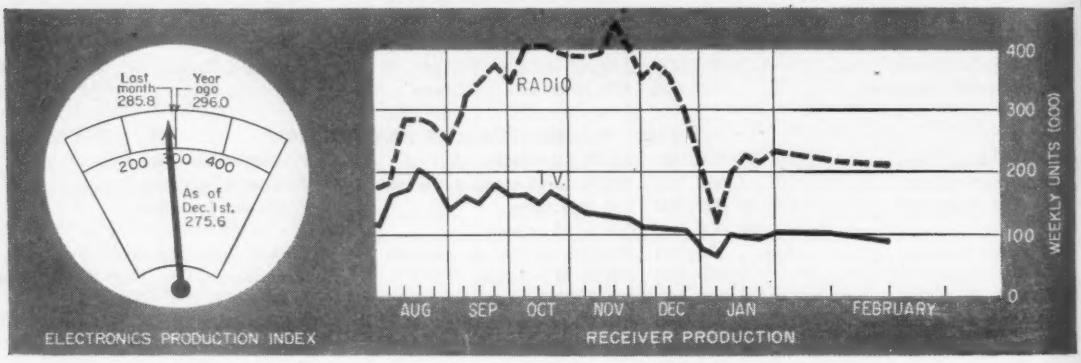
• **Rheem Manufacturing,** headquartered in New York City, enters into credit agreement which provides firm with a five year $10 million loan, as well as $10 million in seasonal credit lines, to provide for 1958 needs. Terms permit payment of cash dividends during life of loan up to 25 percent of earnings plus $1 million.

• **Gabriel Co.,** Cleveland, Ohio, acquires **Bonahan Manufacturing** of Los Angeles, producer of force ejection systems for missiles and aircraft. Price was reported to be about $6 million. Gabriel, a large manufacturer of shock absorbers and antenna for automobiles, also produces antenna for missiles, aircraft and surface radar systems. The Bonahan plant will be operated as a Gabriel division. Present management will be retained.

• **Industro Transistor,** Long Island City, N. Y., increases the amount of authorized common stock. Business has been increasing and the firm wants to be in a position to issue new stock if necessary. However, no definite new issue plans have been made.

• **American Electronics** of Los Angeles called for redemption on March 4 of all of its outstanding percent convertible debentures, due May 1, 1967. The debentures were convertible into common stock until Feb. 27.

• **Polarad Electronics,** Long Island City, N. Y., privately placed $750,000 of convertible subordinated notes through Kidder, Peabody & Co. The notes are due Jan. 1, 1968. Polarad has also obtained an increase in V loan credit from $1.2 million to $1. million. New funds will be used to augment Polarad's working capital position. Polarad makes microwave testing, signal generation and sending and receiving apparatus.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	Feb. 14, '58	Feb. 7, '58	Feb. 15, '57
Television sets, total	98,841	103,730	123,225
Radio sets, total	211,545	224,149	307,909
Auto sets	68,874	76,794	126,450

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Feb. 19, '58	Feb. 12, '58	Feb. 20, '57
Radio-tv & electronics	46.49	45.55	45.97
Radio broadcasters	57.40	56.95	62.23

FIGURES OF THE YEAR

	1957	Totals for first 11 months 1956	Percent Change
Receiving tube sales	456,424,000	464,186,000	− 1.7
Transistor production	28,738,000	12,840,000	+123.8
Cathode-ray tube sales	9,721,008	10,987,021	− 11.5
Television set production	6,399,345	7,387,029	− 13.4
Radio set production	15,427,738	13,981,800	+ 10.3

LATEST MONTHLY FIGURES

EMPLOYMENT AND PAYROLLS

(Source: Bur. Labor Statistics)	Oct. '57	Sept. '57	Oct. '5
Prod. workers, comm. equip.	412,000-p	417,900-r	413,1
Av. wkly. earnings, comm.	$76.44 -p	$78.40 -r	$78.7
Av. wkly. earnings, radio	$74.40 -p	$76.02 -r	$75.7
Av. wkly. hours, comm.	39.0 -p	40.0 -r	40.9
Av. wkly. hours, radio	39.0 -p	39.8 -r	40.7

TRANSISTOR SALES

(Source: EIA)	Dec. '57	Nov. '57	Dec. '5
Unit sales	2,773,000	3,578,700	1,608,0
Value	$6,619,000	$6,989,000	$4,691,0

TUBE SALES

(Source: EIA)	Dec. '57	Nov. '57	Dec. '5
Receiving tubes, units	27,736,000	39,950,000	34,340,0
Receiving tubes, value	$24,881,000	$33,166,000	$29,111,0
Picture tubes, units	644,026	772,801	795,4
Picture tubes, value	$12,971,487	$15,138,438	$13,423,1

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HIGH FREQUENCY POWER TRANSISTORS

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For high frequency audio amplifiers:

(TYPE CTP 1133)

POWER DISSIPATION = 10 WATTS
at 70°C base temperature

POWER GAIN = 27 to 33 db
when Ic = 420 ma and power output = 2.0 w

POWER GAIN CUTOFF FREQUENCY = 20 kc minimum •
. . . compared with 5 to 7 kc for conventional transistors

DISTORTION = 5% maximum
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For high-speed switching:

(TYPE CTP 1135)

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at 70°C base temperature

DC CURRENT GAIN = 40 minimum
at 0.5 amp

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WASHINGTON OUTLOOK

THE FIRST OFFICIAL sign of plans for substantially boosting defense spending—along the vast lines envisaged by the Gaither and Rockefeller committees—shows up in preliminary budget estimates for fiscal 1960, recently turned into Defense Secy. McElroy's office by the three military services.

ELECTRONICS has learned that the so-called "unilateral service plans" for the fiscal year starting July 1, 1959 call for new appropriation requests totaling $49.6 billion. This is almost $10 billion over the fiscal 1959 military budget now being considered by Congress.

FULL LINE DEPTH

Magnetrons from 1 to 5,000,000 Watts — Klystrons from 600 to 60,000 Mc — Backward Wave Oscillators from 1,000 to 15,000 Mc. Plus, a broad line of special tubes including storage tubes, rectifiers, square law and traveling wave tubes. Write for complete data booklet on the most complete line in the industry.

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RAYTHEON MANUFACTURING COMPANY

Microwave and Power Tube Operations, Section PT-32, Waltham 54, Mass.

Regional Sales Offices: 9501 W. Grand Avenue, Franklin Park, Illinois; 5236 Santa Monica Blvd., Los Angeles 29, California

RAYTHEON

SEE RAYTHEON AT THE IRE—BOOTHS 2611-2614

"THREE DEGREES BELOW ZERO"

As a man who has steadily shunned all degrees except honorary ones (I'm still waiting for somebody to speak up) I feel well qualified to discuss the subject. And even though I myself am a prominent scientist—Sec'y.-Treas. of the Lower Bronx Astronautical Society—I must admit I don't think degrees are very important. Of course, my viewpoint might change. Especially if I can wheedle some college into awarding me a Ph.D. (Phenomenal Droodlist). Ah, well, who can tell what the future will bring?

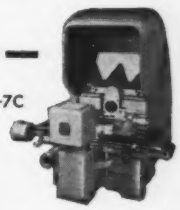
One thing the future is sure to bring is the increasing use throughout industry of the J&L Optical Comparator. This is an ingenious instrument which measures and inspects all sorts of parts and objects laterally, vertically and angularly—it also inspects by reflection, by tracing and from overhead—with speed and precision (to .0001").

The photo above shows how a J & L Comparator is used by National Seal Division of Federal-Mogul-Bower Bearings, Inc., Redwood City, Calif., to inspect and measure high precision rubber moldings. Due to the flexibility and shrinkage of the parts, accurate measurement can be made only by means of the Comparator. Using reflected light, the Comparator visualizes the actual manufacturing process. That is, the cross section inspection at 20X of the moldings themselves. Based on this inspection, the molds are approved. Periodically, as a check, production parts are measured and compared in contour to the same chart outline. Thus the Comparator acts as a monitor, and reduces scrap before it starts.

Jones & Lamson makes the Comparator in eleven models, ranging from a 7" Bench type to a 30" floor model. For complete details, send this coupon *today*.

"The originator of machine tool standards in optical inspection"

JONES & LAMSON



Bench Model BC-7C

JONES & LAMSON MACHINE COMPANY, Dept. 710, 539 Clinton Street, Springfield, Vt., U.S.A.
Please send me Comparator Catalog 5700, which describes the complete line of J & L Optical Comparators.

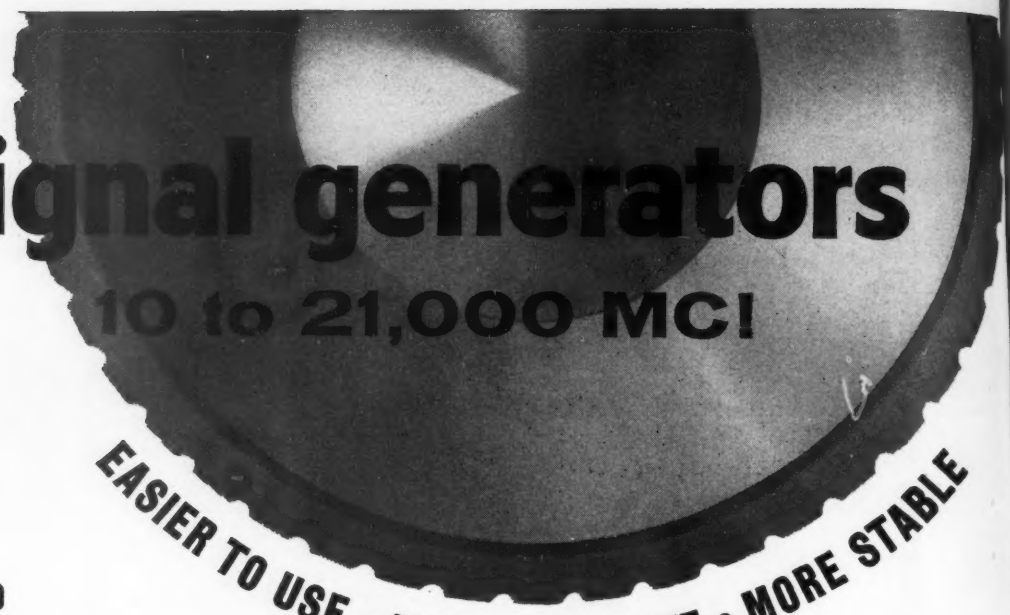
name _____ title _____

company _____

street _____

city _____ zone _____ state _____

386



signal generators

10 to 21,000 MC!

EASIER TO USE • MORE ACCURATE • MORE STABLE

11 TO CHOOSE FROM

With *-hp-* signal generators, frequencies are directly set and read on one dial. Output voltage is directly set and read. No calibration charts are required. Most *-hp-* generators offer internal pulse, FM or square wave modulation; some include external pulsing and FM'ing. New *-hp-* 626A (10 to 15.5 KMC) and 628A (15 to 21 KMC) offer 10 mw output, SWR 1.2.

-hp- signal generators outsell other signal sources by approximately 2:1. Engineers report the reasons are simpler operation, versatility, trouble-free performance, and exceptional value.

Instrument	Frequency Range	Characteristics	Price
-hp- 608C	10 to 480 MC	Output 0.1 μv to 1 v into 50 ohm load. CW, pulse or AM mod. Direct calibration.	$ 950.00
-hp- 608D	10 to 420 MC	Output 0.1 μv to 0.5 v into 50 ohm load. CW, pulse or AM mod. Direct calibration and crystal calibrator check	1,050.00
-hp- 612A	450 to 1,230 MC	Output 0.1 μv to 0.5 v into 50 ohm load. Pulse, CW or amplitude modulation to 5 MC Direct calibration.	1,200.00
-hp- 614A	800 to 2,100 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration.	1,950.00
-hp- 616A	1,800 to 4,000 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calibration.	1,950.00
-hp- 618B	3,800 to 7,600 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration.	2,250.00
-hp- 620A	7,000 to 11,000 MC	Output 0.1 μv to 0.223 v into 50 ohm load. Pulse, CW, FM or square wave modulation. Direct calibration.	2,250.00
-hp- 623B	5,925 to 6,575 MC; 6,575 to 7,175 MC; 7,175 to 7,725 MC	Output 70 μv to 0.223 v into 50 ohm load. FM or square wave modulation. Separate power meter and wave meter section.	1,900.00
-hp- 624C	8,500 to 10,000 MC	Output 3.0 μv to 0.223 v into 50 ohm load. Pulse, FM or square wave modulation. Separate power meter and wave meter section.	2,265.00
-hp- 626A	10,000 to 15,500 MC	Output 1 $\mu\mu$watt to 10 mw. Internal or external pulse, FM, or square wave modulation. Direct calibration.	3,250.00
-hp- 628A	15,000 to 21,000 MC	Output 1 $\mu\mu$watt to 10 mw. Internal or external pulse, FM, or square wave modulation. Direct calibration.	3,000.00

Your -hp- field engineer has complete data on all -hp- generators. Or, write direct.

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CABLE "HEWPACK" • DAVENPORT 5-4451

FIELD ENGINEERS IN ALL PRINCIPAL AREAS

complete coverage, outstanding value

Raising New Money

$300 million of new capital raised by 32 firms in last six months of 1957. Private placements mount

ELECTRONICS FIRMS raised almost as much new capital in the last half of 1957 as in the first half, despite a falling stock market since July.

Three hundred million dollars was raised by 32 firms from July to December, compared with $327 million raised by 30 firms from January to June, according to Investment Dealers' Digest.

Private placements increased sharply in the last six months period. Some $88 million, or 30 percent of the total, came from private placements in the July-December period. In the first six months private placements amounted to $27 million, or eight percent of the total.

Privately placed securities are sold directly to a few large investors, not offered for general sale to the public.

PUBLIC SECURITY ISSUES JULY–DEC. 1957

Company	Value	Description	Underwriter or Lender	Sales Cost
Amphenol Electronics	$5,500,000	200,000 shs common @ 27½	Hornblower & Weeks	6.4%
Electro Instruments	625,000	50,000 shs common @ 12½	Bear, Stearns	10.0%
Electronic Res. Assocs.	300,000	100,000 shs class A com. @ 3	Singer, Bean & Mackie	15.0%
Emerson Electric	3,390,000	5½% 20 yr conv. sub. debentures	Smith, Barney	1.5–2.5%
Epsco	960,000	60,000 shs common @ 16	W. C. Langley	9.4%
General Tire & Rubber	12,000,000	6% 25 yr sub. debs. w. warrants	Kidder, Peabody	1.87½%
Haydu Electronics	300,000	100,000 shs common @ 3	Berry & Co.	15.0%
Hycon Manufacturing	1,200,000	400,000 shs common @ 3	Dempsey-Tegeler	10.0%
Minneapolis-Honeywell	28,155,145	331,237 shs common @ 85	Eastman Dillon	1.3–3.4%
Narda Microwave	270,000	90,000 shs common @ 3	Milton D. Blauner	12.5%
Perkin-Elmer	1,500,000	75,000 shs common @ 20	Blyth & Co.	7.0%
Sanders Associates	1,500,000	100,000 shs class A com. @ 15	Kidder, Peabody	8.0%
Siegler Corp.	4,800,000	320,000 shs common @ 15	William R. Staats	7.0%
Smith-Corona	4,235,700	6% 20 yr conv. sub. debs.	Lehman Brothers	2.5%
Sperry-Rand	110,000,000	5½% 25 yr debs. w. warrants	Lehman Brothers	1.15%
Statham Instruments	1,250,000	100,000 shs common @ 12½	Blyth & Co.	8.0%
Thompson Products	19,729,500	4⅞% 25 yr conv. sub. debs.	Smith Barney	1.1–1.9%
Tracerlab	675,966	112,661 shs common @ 6	Lee Higginson	.....
Tung-Sol Electric	5,000,000	100,000 shs conv. 5% pfd. @ 50	Harriman, Ripley	3.5%
Victoreen Instrument	700,000	6% 10 yr conv. sub. debs.	Saunders, Stiver	2.0–5.5%

PRIVATELY PLACED SECURITIES JULY–DEC. 1957

Aeroquip Corp.	$1,000,000	5½% 10 yr notes	Prudential Insurance
Aircraft Radio	1,600,000	5½% 15 yr notes w. warrants	Prudential Insurance
AMF Pinspotters	20,000,000	5% 5 yr notes	Prudential & 1 other
" "	40,000,000	5¾% 15 yr notes	" "
Audio Devices	App. 1,000,000	100,000 shs com. w. warrants	Carl M. Loeb, Rhoades & Co.
Cook Electric	2,000,000	5¾% 10 yr notes	Mass. Mutual Life (Blunt Ellis & Simmons)
Dictaphone Corp.	4,000,000	5¼% 20 yr notes	Mutual of N.Y. & others
Monroe Calculating	2,500,000	5% 10 yr sub. notes	Mass. Mutual Life
Perkin-Elmer	2,000,000	5⅜ 15 yr notes	Prudential Insurance
Rome Cable	5,000,000	4¼–4¾% 5–15 yr notes	Conn. Mutual Life & Mass. M. L.
Siegler Corp.	3,000,000	5½% 12 yr notes	New England Mutual Life (Wm. R. Staats)
Tung-Sol Electric	5,000,000	5¼% 10 yr notes	Prudential Insurance
Varo Manufacturing	1,000,000	6% 10 yr notes	Guardian Life (Shearson Hamill)

SHARES and PRICES

ACCORDING to the Air Force, the four contractors listed below are participating in construction of an early warning system for detection of missiles. Ultimate cost will be about $721 million. Initial funds, included in the President's supplemental budget requests, have already been approved. RCA is the prime contractor.

Some Missile Detection System Contractors	Recent Price	Indicated Dividend Rate	Percent Yield	Earned Per Common Share 1957	Period	1956	Traded	1957–1958 Price Range
RCA	33½	1.50	4.5	1.87	(9 mos)	1.82	NYSE	27 –40
General Electric	60¾	2.00	3.3	2.10	(9 mos)	1.85	NYSE	52⅜–72⅜
Goodyear Tire	70	2.40[1]	3.4	6.12	(yr)	5.90	NYSE	69 –95¼
Sylvania	36⅛	2.00	5.5	2.37	(9 mos)	3.20	NYSE	29¼–46¼

[1] plus stock

MERGERS, ACQUISITIONS and FINANCE

• **High Voltage Engineering,** Burlington, Mass., manufacturer of particle accelerators, acquires controlling interest in **Electronized Chemicals** of New York City. EC has U. S. and foreign patents in electron processing which supplement HV patents in same field. John M. McCarthy, vice president and comptroller of High Voltage, becomes president of its new subsidiary. The acquisition is expected to strengthen High Voltage's position in radiation equipment for processing chemical materials and for sterilizing surgicals, drugs and food.

• **General Transistor,** Jamaica, N. Y., purchases the former **Dunn Worsted** plant in Woonsocket, R. I., which will be used for production of newly developed semiconductor products. The R.I. plant is expected to employ 500 people this year, 1,000-2,000 eventually. GT now employs 500 people in four Long Island plants. The new products will probably include silicon and germanium diodes and rectifiers.

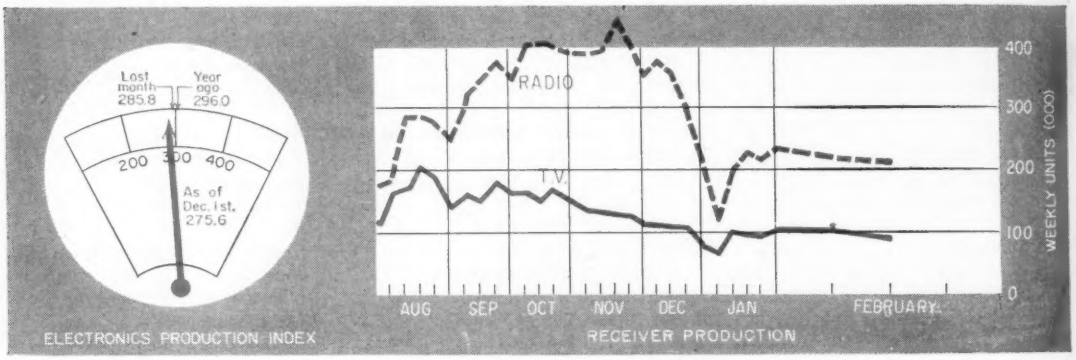
• **Rheem Manufacturing,** headquartered in New York City, enters into credit agreement which provides firm with a five year $10 million loan, as well as $10 million in seasonal credit lines, to provide for 1958 needs. Terms permit payment of cash dividends during life of loan up to 25 percent of earnings plus $1 million.

• **Gabriel Co.,** Cleveland, Ohio, acquires **Bonahan Manufacturing** of Los Angeles, producer of force ejection systems for missiles and aircraft. Price was reported to be about $6 million. Gabriel, a large manufacturer of shock absorbers and antenna for automobiles, also produces antenna for missiles, aircraft and surface radar systems. The Bonahan plant will be operated as a Gabriel division. Present management will be retained.

• **Industro Transistor,** Long Island City, N. Y., increases the amount of authorized common stock. Business has been increasing and the firm wants to be in a position to issue new stock if necessary. However, no definite new issue plans have been made.

• **American Electronics** of Los Angeles called for redemption on March 4 of all of its outstanding 5 percent convertible debentures, due May 1, 1967. The debentures were convertible into common stock until Feb. 27.

• **Polarad Electronics,** Long Island City, N. Y., privately placed $750,000 of convertible subordinated notes through Kidder, Peabody & Co. The notes are due Jan. 1, 1968. Polarad has also obtained an increase in V loan credit from $1.2 million to $1.7 million. New funds will be used to augment Polarad's working capital position. Polarad makes microwave testing, signal generation and transmitting and receiving apparatus.



FIGURES OF THE WEEK

RECEIVER PRODUCTION

(Source: EIA)	Feb. 14, '58	Feb. 7, '58	Feb. 15, '57
Television sets, total	98,841	103,730	123,225
Radio sets, total	211,545	224,149	307,909
Auto sets	68,874	76,794	126,450

STOCK PRICE AVERAGES

(Source: Standard & Poor's)	Feb. 19, '58	Feb. 12, '58	Feb. 20, '57
Radio-tv & electronics	46.49	45.55	45.97
Radio broadcasters	57.40	56.95	62.23

FIGURES OF THE YEAR

	1957	Totals for first 11 months 1956	Percent Change
Receiving tube sales	456,424,000	464,186,000	− 1.7
Transistor production	28,738,000	12,840,000	+123.8
Cathode-ray tube sales	9,721,008	10,987,021	− 11.5
Television set production	6,399,345	7,387,029	− 13.4
Radio set production	15,427,738	13,981,800	+ 10.3

LATEST MONTHLY FIGURES

EMPLOYMENT AND PAYROLLS

(Source: Bur. Labor Statistics)	Oct. '57	Sept. '57	Oct. '56
Prod. workers, comm. equip.	412,000-p	417,900-r	413,100
Av. wkly. earnings, comm.	$76.44 -p	$78.40 -r	$78.78
Av. wkly. earnings, radio	$74.40 -p	$76.02 -r	$75.70
Av. wkly. hours, comm.	39.0 -p	40.0 -r	40.9
Av. wkly. hours, radio	39.0 -p	39.8 -r	40.7

TRANSISTOR SALES

(Source: EIA)	Dec. '57	Nov. '57	Dec. '56
Unit sales	2,773,000	3,578,700	1,608,000
Value	$6,619,000	$6,989,000	$4,691,000

TUBE SALES

(Source: EIA)	Dec. '57	Nov. '57	Dec. '56
Receiving tubes, units	27,736,000	39,950,000	34,340,000
Receiving tubes, value	$24,881,000	$33,166,000	$29,111,000
Picture tubes, units	644,026	772,801	795,476
Picture tubes, value	$12,971,487	$15,138,438	$13,423,157

Another Clevite Break-through!

HIGH FREQUENCY POWER TRANSISTORS

This history-making addition to Clevite's line of PNP germanium power transistors offers long-sought advantages to designers of high frequency audio amplifiers as well as high-speed switching and core driver circuitry in digital computers.

For high frequency audio amplifiers:

(TYPE CTP 1133)

POWER DISSIPATION = 10 WATTS
at 70°C base temperature
POWER GAIN = 27 to 33 db
when Ic = 420 ma and power output = 2.0 w
POWER GAIN CUTOFF FREQUENCY = 20 kc minimum •
. . . compared with 5 to 7 kc for conventional transistors
DISTORTION = 5% maximum
at 1.2 w output

For high-speed switching:

(TYPE CTP 1135)

POWER DISSIPATION = 10 WATTS
at 70°C base temperature
DC CURRENT GAIN = 40 minimum
at 0.5 amp
COMMON EMITTER GAIN BANDWIDTH PRODUCT = 1 megacycle

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For complete information write or phone:

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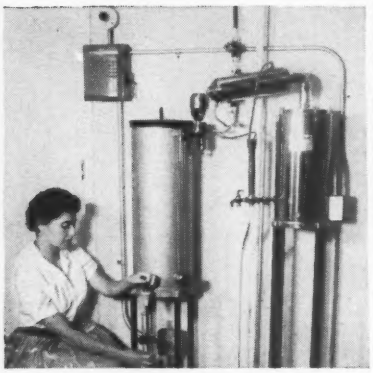
Small roller bearings . . . some as tiny as the period at the end of this sentence are produced by Miniature Precision Bearings, Inc., of Keene, N.H. with an assist from Barnstead Distilled Water.

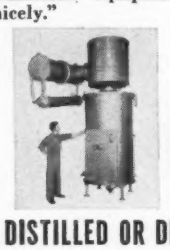


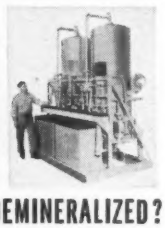
Even Roller Bearings *ROLL* Better With

BARNSTEAD

Distilled Water

Barnstead Stills provide a reliable source of *purest water* in either laboratory or production quantities. At Miniature Precision Bearings, Inc., this is what they say: "This water Still is used in our vital laboratory work on the metallurgy of metals in our bearings and tools. A great deal of time is spent in analyzing the causes of bearing failure. . . . Dust for example, is analyzed optically and chemically. . . . Naturally, the purest distilled water is needed for much of this work and Barnstead equipment fills this need nicely."





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CIRCLE 4 READERS SERVICE CARD

WASHINGTON OUTLOOK

THE FIRST OFFICIAL sign of plans for substantially boosting defense spending—along the vast lines envisaged by the Gaither and Rockefeller committees—shows up in preliminary budget estimates for fiscal 1960, recently turned into Defense Secy. McElroy's office by the three military services.

ELECTRONICS has learned that the so-called "unilateral service plans" for the fiscal year starting July 1, 1959 call for new appropriation requests totaling $49.6 billion. This is almost $10 billion over the fiscal 1959 military budget now being considered by Congress.

Biggest chunk of the increase—some $6 billion—would go for added procurement and production of military hard goods. The most eye-raising item in the proposed increase is for output of manned aircraft—$10.7 billion, compared to only $6.9 billion in the fiscal 1959 budget.

New funds for missile production total $3.9 billion, up only $300 million from the current new budget; for shipbuilding, $1.9 billion, up $600 million over the current spending estimate; for research and development, $2.6 billion, $600 million more than the latest appropriation request.

- The fact that the services want $49.6 billion in new funds for fiscal 1960 does not mean, of course, that the Administration's defense budget that goes to Congress next January will add up to this sum.

  The fiscal 1959 budget, for instance, totaling $39.7 billion in requests for new military funds, is $9.3 billion under three services' preliminary estimates. The Administration may be less tight-fisted this year in putting together the fiscal 1960 budget.

  Indeed, there's talk of a supplemental defense appropriation request for fiscal 1959, to be submitted to Congress before the original appropriation request is even voted upon. According to Pentagon sources, this might total roughly $2 billion, might include sums for more "conventional weapons" like B-52's, jet tankers, advanced Army small arms, the subsonic Snark missile and the like.

  There is considerable Pentagon opinion that the Administration is taking a big risk in failing to continue production of so-called "interim" weapons like B-52's and Snarks, while pushing the crash program on ballistic missiles.

- **The Pentagon's new listing** of top defense contractors demonstrates again electronics industry's growing role in military production. Nine of 15 leading contractors during January 1955-June 1957 period are either exclusively in electronics or are aircraft companies with important electronics subsidiaries—General Dynamics ranks first, with $2.3 billion in new orders for the period.

  Others, in order: GE, $1.9 billion; North American Aviation, $1.8 billion; AT&T, $1.3 billion; Lockheed, $1.2 billion; Hughes Aircraft, $867 million; Martin, $772 million; IBM, $637.5 million; and GM, $585.4 million.

  Other major electronic contractors are: Bendix Aviation, $546.4 million; Sperry Rand, $430.1 million; Raytheon, $397.4 million; RCA, $354.7 million; Avco, $297.7 million; Westinghouse, $284 million; American Bosch Arma, $189.3 million; Philco, $182.3 million; Collins Radio, $152 million; IT&T, $149.6 million; General Precision, $146.5 million; Minneapolis-Honeywell, $142.6 million; Burroughs, $136.9 million.

NEW TAX CLIMATE

for your new plant

The fact that Pennsylvania manufacturers will save an estimated $45 million in taxes during the current biennium proves our point. To create this "tax climate" favorable to new and expanding industry, the state legislature has taken these steps:

1. Exempted manufacturers from capital stock and franchise tax.
2. Eliminated local *ad valorum* property taxes on machinery and equipment (there is no state-level general property tax).
3. Repealed tax on stock transfers.
4. Made 3% sales tax permanent—now the principal source of state revenues.
5. Reduced the sales tax on purchases by manufacturers.

Add the fact that Pennsylvania has no state personal income tax, and you can see how all this creates a favorable tax climate. Use the coupon below for details.

WEST PENN POWER

an operating unit of the WEST PENN ELECTRIC SYSTEM

Hello...

I'm Charlie Fife. I want to stress the point that this good tax news is only one of many facets that interest manufacturers in expansion in WESTern PENNsylvania.

For example, we have communities offering **100% financing** in attractive lease/purchase agreements; interest as low as 2%, with deferred amortization, can be applied on up to 50% of total plant cost.

Skill surveys and labor inventories in our files show the true picture of **labor availability,** both male and female.

We'll gladly assign a **plant location specialist** to personally assist in your evaluation of WESTern PENNsylvania. There is no charge for this professional service. And, you can be sure that West Penn Power will respect your confidence.

CHARLES M. FIFE, *Manager*
Area Development Department

WEST PENN POWER, Area Development Department, Cabin Hill, Greensburg, Pennsylvania E-1

Yes, I'm interested in WESTern PENNsylvania:

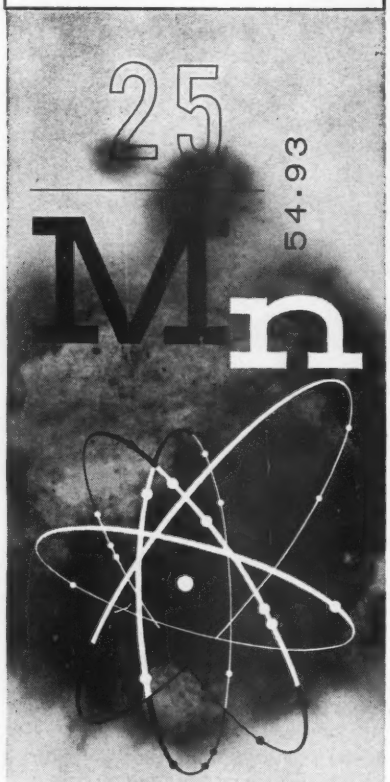
☐ Please send details on taxes. ☐ Please send booklet, "Plant Location Services."

Name_____ Title_____

Company_____ Street_____

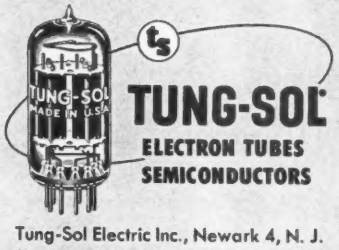
City_____ Zone_____ State_____

ACCEPTED SYMBOLS



Symbol for manganese . . . the element used in cathode sleeves of electron tubes to give the tube the ability to emit electrons.

Just as Mn is the accepted symbol for manganese, so Tung-Sol represents the highest quality production of electron tubes to volume requirements. This ability is an important reason why Tung-Sol is America's largest independent electron tube manufacturer.



TUNG-SOL
ELECTRON TUBES
SEMICONDUCTORS

Tung-Sol Electric Inc., Newark 4, N. J.
Manufacturers of Automotive and Electronic Components.

CIRCLE 6 READERS SERVICE CARD

EXECUTIVES IN THE NEWS

Sprague: facts, skis and the Fed

CONTROVERSY is still raging over the report of the Gaither panel, which Robert C. Sprague directed during its last months. On Mar. 26, Sprague comes back into the spotlight with another topic close to his heart: the Federal Reserve System, which he will discuss before the IRE Banquet. It's no new topic to Sprague; as chairman of Boston's Federal Reserve Bank, he tries constantly to make the Fed's functions clear to New England businessmen.

Sprague, who was 57 last August, was graduated from Annapolis in 1920, took a B.S. at the Naval Graduate School a year later and an M.S. in naval architecture at MIT in 1924. His scientific training bred a strong scientific curiosity, which in turn led to the founding of Sprague Electric.

One night in 1926, he became dissatisfied with the tone of his radio. He started tinkering, built a multitap capacitor tone control. It made such a marked improvement that he formed a company to build and market the controls. Later he recognized the existence of a larger market for the capacitors themselves, began making them. In 1928 he resigned from the Navy to concentrate on his growing firm.

"To him," an associate says of Sprague, "facts are sacred." He likes plain talk, hates "mere words." His respect for facts and articulate knowledge keeps him in demand as an advisor to industry and government. He has served in the two top posts of RETMA (now EIA), is currently consultant on continental defense to the National Security Council, also advises the Office of Defense Mobilization.

Sprague makes a point of having spare time. In the summer, he likes tennis a lot and swimming a little, says "we have a pool but my grandchildren use it." In the winter, he skis. Last year he made a mathematical analysis of skiing, published it privately at year's end for "a few friends."

COMMENT

Auto Controls

Your short article on developmental work in electronic car controls ("Electronic Car Control Nears," Feb. 7, p 44) points up a greatly neglected field for electronic and electromechanical control. The potentialities of using

automatic controls in the mass transportation of people have not been scratched.

The failure to recognize the potentiality of automatic controls and to use them in modernization of public transportation (essentially unchanged since the horse car) are at the root of the decline of public transit, of the railway commuter problem, of urban congestion due to parking, and excess use of streets by private cars.

DONN H. HARPER
MEMPHIS, TENN.

Oops!

Seldom do I write, but on p 71 of your Jan. 17 issue, the circuit diagram (Fig. 1 of "Self-Setting Servo Gate," Jan. 17, p 71) you have the input running to ground.

Is this a new type of circuit? Or at 75 kc is there enough inductance in the lead for isolation? I think not.

I like your publication. Keep it up.

R. E. CLINK
EL MONTE, CALIF.

It isn't and there isn't and you're right to think not. We'll try to keep it up, but without grounding our inputs.

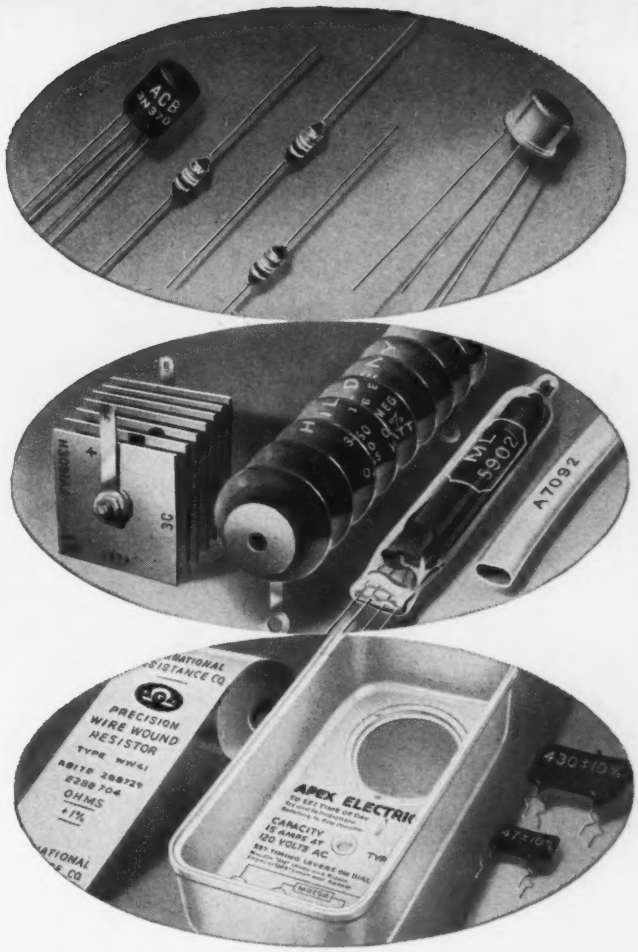
Ozone Detector

A sensitive ozone detector was formalized, finalized and implementized in the following form: A glassized and wireized sensing element was constructed. The platinum type electrodes of the sensing element are batteryized and the current resulting from the electrolysis of the chemicalized iodine is fed to an amplifier.

The amplifier was transistorized, wireized with copper type wire, resistorized, capacitorized, ruggedized and miniaturized. The output of the amplifier is fed into a tubeized transmitter.

EDWARD V. ASHBURN
U. S. NAVAL ORDNANCE TEST CENTER
CHINA LAKE, CALIF.

As another poet once said, "A soothsayer bids you beware the ize of March."



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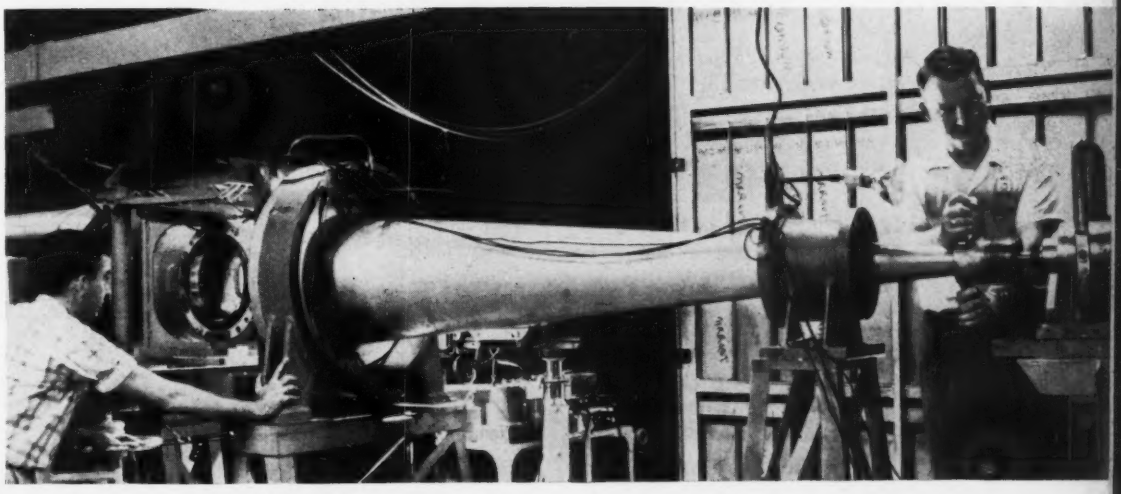


Air Force uses electric-arc wind tunnel to simulate aerodynamic behavior of far-hypersonic aircraft and missiles. Electronic problem lies in forcing radio signals through air heated to ionization temperature as . . .

Ions Make Trouble at Mach 10

ROCKET PLANES like the X-15, scheduled for test this year, will create still another electronic problem when they begin traveling through the atmosphere at speeds of 4,000 mph and faster.

At hypersonic speeds, a conductive layer of ionized air will be formed around the plane by aerodynamic heating. This blanket can weaken or even black out radio communications at the frequencies and transmitter powers used today.

Nevertheless, North American Aviation, developer of the X-15, says radio contact will be maintained. A system is being designed by Collins Radio.

As another part of the project, Electronic Engineering Co., is installing telemetering, data transmission and communications facilities in a 400-mi test range centering around Edwards Air Force Base. The range will be ready in 1960.

The X-15's mach-6 speed just about brings it to ionization velocity. The problem would become more acute with far-hypersonic craft such as the rocket orbital bomber currently sought by the Air Force.

Ideally, hypersonic planes will fly above atmosphere with greater efficiency than is possible with air-bound planes. But they will have to get up to and down from space and may have to skip into air to prolong flight.

Two layers of air form around such vehicles in the atmosphere. The outer layer is thick and bears the aerodynamic shock as it moves along. Between this and the vehicle's skin, a boundary layer of stagnant air soaks up the heat of passage. The inner layer becomes hot enough to ionize the air it traps.

Boundary layer ionization will further complicate the many problems already inherent in communication with high-speed missiles: Doppler shift, ionospheric refraction, atmospheric noise and the ionized trail which balloons behind the rocket flame exhaust.

The problem is old hat to missile testers investi-

gating what happens to a nose cone in reentry. They solve it by avoiding it. GE, for example, uses an electronic recorder in a recovery capsule to preserve critical reentry data which cannot be telemetered because of ionization.

Such electronic isolation, however, could be intolerable in the "manned missiles" now contemplated.

ARDC has begun research into the screening effects of high concentrations of charged particles, preparing for future weapons systems.

Research reports published by Avco and Lockheed personnel (see graphs) indicate the trouble begins at about mach 6 when molecular energy balance is disturbed. It becomes serious above mach 10, where oxygen dissociates. At mach 18 and 150,000 feet altitude, the boundary layer has almost the conductivity of fused sodium chloride.

The basic electronic problem is obvious. The ionized layer attenuates transmission. Speed and altitude govern the amount of blocking; vehicle shape determines directional factors, antenna location and design.

All the ramifications are not known. Frequencies can be tested in an ionized salt solution. To recreate actual conditions requires expensive and tedious experimentation with arc jets, shock tubes and, eventually, trial and error in test vehicles.

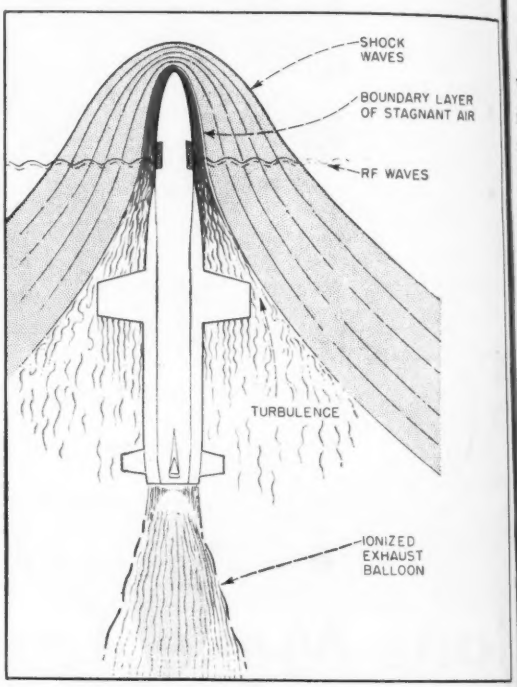
Scraps of information passing through military classification indicate that the problem is nearly at hand:

Radome designers are working on materials to withstand high thermal shock and temperatures of 2,500 F to 6,000 F, temperatures expected up to mach 10.

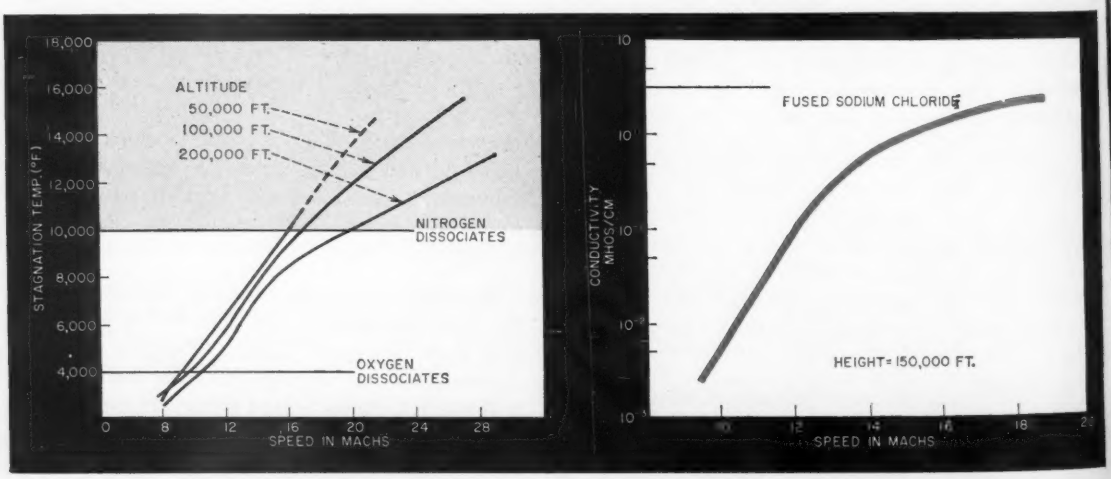
A number of firms are reported developing 80 to 100 kilomegacycle components and systems. The higher the frequency, the less db loss in the ionized layer.

Aerodynamic engineers are investigating what happens when an object moves through air at satellite speeds.

Another complication that may become significant is the fact that light metals will ionize at even low hypersonic speeds. Some think the boundary layer should be deliberately seeded with metal so it will support an electromagnetic field as a reentry brake—ionic propulsion in reverse.



Sketch shows ionized regions forming around nose of hypersonic plane and in rocket exhaust. Graphs (below) illustrate rate of heat buildup in boundary layer and conductivity of air at hypersonic speeds



Gearing Up to Conquer Space

Military and civilian agencies are spending about $2.3 billion this year for space science and weapons. Spending will rise to some $2.7 billion in fiscal 1959. Question now arises: who will sit in the driver's seat? Whichever way the ball bounces the electronics industry stands to profit plenty

WASHINGTON—Over the past few months, the idea of space flight has emerged from the realm of science fiction into the arena of national policy and politics. And while the space scientists shift from the laboratory to the workshop, the politicians are comparing the significance of space exploration with the 15th and 16th century explorations of the Western Hemisphere.

For the electronics industry, the conquest of space provides a new challenge in development and production techniques and a promise of a burgeoning new market in upcoming decades.

That's why electronics makers are intimately involved in the current Washington debate over (1) whether civilian authorities or the military establishment should be in charge of the space program, and (2) a scientific timetable for launching new satellites and manned vehicles beyond the earth's atmosphere.

In Washington, future space policy is being resolved on two fronts:

A White House Science Advisory Group, led by James R. Killian, the President's Special Assistant for Science and Technology, is drafting a plan laying out the objectives of U. S. space exploration.

The Killian group is also specifying the type of government organization to run the show. The proposal will tie into the Administration's forthcoming package of military reorganization plans.

On Capitol Hill, the Senate has set up a 17-man Special Committee on Astronautical and Space Exploration, headed by Majority Leader Lyndon B. Johnson of Texas, to frame a comprehensive "national policy toward the age of space."

The House is organizing a similar committee. The outlook is for basic legislation for space matters, comparable in scope to the Atomic Energy Act of 1946.

Meantime, in the Pentagon the Defense Dept.'s new Advanced Research Projects Agency is about to start operating. Roy W. Johnson, retiring GE vice president, is the new agency's director.

ARPA will pull the strings on the program to develop anti-ICBM defenses and military space hardware, farming out to the individual military

Who'll Head Space R&D?

Several major proposals for organizing the space exploration program are now being studied:

- **Space exploration should be put under the aegis of AEC.** AEC Chairman Strauss says his agency "Has made no overtures to take over" the space program. AEC has worked on development of nuclear-powered rockets for at least three years, now seeks extra funds to push work on a nuclear rocket and on an ionic jet rocket requiring atomic energy as an initial power source.

- **The National Advisory Committee on Aeronautics coordinate and supervise general space scientific research.** Meanwhile, Defense Dept. would continue development and operation of military missiles, satellites and space vehicles.

- **A new agency, to be called the National Space Establishment, should be created to conduct space exploration.** The influential American Rocket Society and the National Academy of Science's rocket and satellite panel are pushing the scheme, which envisages annual $1-billion budgets over the next decade for general space science research. Production of military space weapons would be directed and financed by the Defense Dept.

- **The National Science Foundation would direct space research.** This, proponents say, would provide "the fullest development of inner and outer space relating to communication, transportation, commerce and weather study.

services contracting and operating details on specific projects. Too, the new Pentagon agency will coordinate most of the government's general space science research for up to a year—or until the Administration and Congress iron out full details for civilian control of the space program.

Considering the present political climate in Washington, it's generally assumed that there will be overall civilian control of space exploration.

Considerable bureaucratic jockeying for direction of the program is now under way, which brings back to mind the controversy of a decade ago over atomic energy. But it's a bureaucratic struggle not merely between the civilian and the military, but also among the few civilian agencies already engaged in space flight research and development (see box).

The proponents of civilian space control believe that the implications of space technology are too wide-ranging to allow military domination of the program. They believe that if the Defense Dept. were to run the show, the search for general scientific knowledge would be submerged in the push to build military hardware.

According to best estimates, the Defense Dept. and civilian agencies are spending about $2.3 billion this year for "space science and weapons."

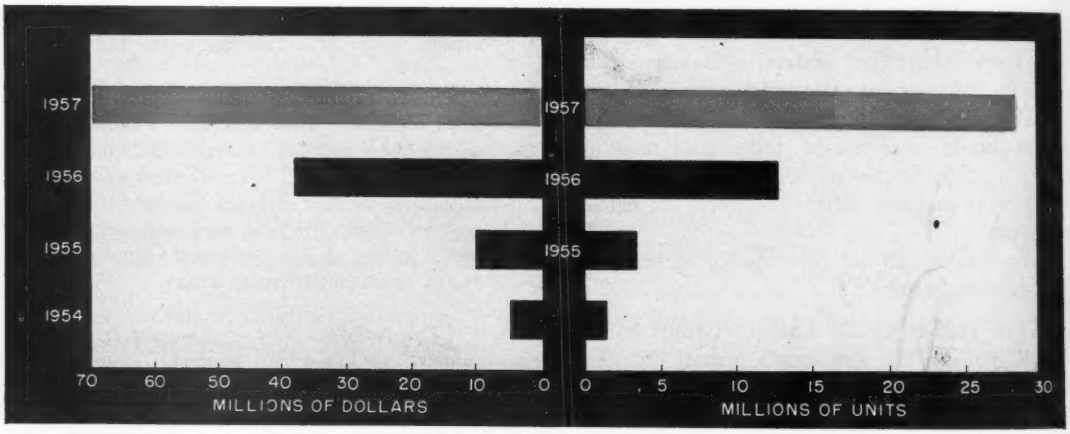
This includes $1.4 billion for production of ballistic missiles—which in effect have proven to be the key to space flight—and $900 million for development of satellites and new rocket engines and basic scientific studies.

In fiscal 1959, starting next July 1, spending will rise to some $2.7 billion.

Of this sum, $1.7 billion will be for ballistic missile production. New appropriation figures show best how the spending trend is being accelerated.

The Administration seeks $3.5 billion in new funds for space weapons and science in fiscal 1959 compared to the $2 billion sum voted for 1958.

PRODUCTION and SALES



Transistor Sales $70 Million in 1957

TRANSISTOR SALES are going up, up and up further.

Dollar sales of the semiconductors totaled $69,739,000 last year while unit sales totaled 28,738,000, according to tabulations by Electronic Industries Association.

Dollar sales increased 87 percent in the past year. Unit sales increased 123 percent.

The greater increase in unit sales bears witness to the industry's improved production ability and consequent lowering of transistor prices. The past year saw many announcements of transistor price reductions which are continuing this year.

Transistor dollar sales have grown by leaps and bounds since 1954, the first year of significant production. Sales volume amounted to $37,352,000 in 1956, some $9,860,000 in 1955 and $4,760,000 in 1954. Sales increased 107 percent between 1954 and 1955, and 379 percent between 1955 and 1956.

Unit sales totaled 12,840,000 last year, 3,647,000 in 1955 and 1,318,000 in 1954. Unit sales increased 177 percent between 1954 and 1955, and 252 percent between 1955 and 1956.

Despite this impressive growth 1957 transistor sales were not up to expectations. Industry leaders had predicted unit volume would be about 30 to 32 million units.

Like the rest of the industry, transistor sales in the last four months of last year were not quite up to par. Sales flattened out in September, October and November. In December they declined slightly.

What's Ahead in Computers

Research extends computer technology to include magnetics, cryogenics, microwaves and masers. What goes on in the labs now determines state of the art in 3 to 5 years. Here's a long look . . .

NEXT THREE YEARS will be critical ones in the computer technology. The $300-million-plus computer industry sinks a lot of money into R&D. So much is happening that anything can happen.

Computer builders are under pressure to increase the speed of their systems and cut the price. Builders and users alike pose an even more serious demand: increase the reliability.

Brand new concepts are coming. Machines will be made to take in and dump out information in a hurry, even at the expense of internal speeds. Machines with learning ability may result from research in the learning process of the human brain.

One trend can be clearly seen: researchers and engineers want to get away from using components designed for the radio industry. They could build a 50-mc computer using currently available tubes and parts with coaxial delay lines for storage (IBM has done it). But it's wasteful.

Computer men want more than just computer-oriented components. They want to perform logical operations—gating, for example—right in the component. The unanswered question: exactly how specialized should a component be? Where do you hit the law of diminishing returns?

The industry is in a state of flux right now. Half of its many voices scream for more speed, higher capacity. Here and there a voice is raised saying "is all this speed—anything above say 100-mc basic rate or 10-mc pulse rate—really necessary?"

Almost everybody working in the industry agrees:

Reliability of operation needs to be improved. There isn't a good statistical basis for determining what are valid reliability rates and requirements. IBM, for one, is currently researching this problem, hopes to arrive at a sound base soon.

The biggest problem is still the same: input and output. A lot of effort in the major computer centers is being plowed into character recognition, including reading handwriting. Improved output devices—faster and quieter printers, plotters, tape units and card punchers—are also being sought.

I. Semiconductors

Machines of the near future—IBM's STRETCH, Remington Rand Univac's LARC, Burroughs' MATABE—are transistorized. Lots of smaller machines are transistorized in whole or part. Principles in these machines will be included in computers coming out in two years or so.

Bell Labs is working with transistors "well above" 1,000 mc and figures on pushing the horizon continually upward. You can find reliable 100-mc transistors being mocked up in circuits in development labs to handle pulse rep rates in the 1-mc range.

Transistor circuitry to handle 100-mc pulse rep rates may be feasible within three to five years but it gets harder to move the technological barrier with each increase in frequency.

II. Magnetics

Ferromagnetism is an odds-on favorite in memory systems for today and the foreseeable tomorrow. For logic circuitry, its star is less bright.

One key to making smaller memories is Bell Labs' twistor, pictured on the cover with its inventor, A. Brobeck. The twistor (ELECTRONICS, Dec. 1 '57, p 7) uses magnetic wire woven like a window screen. One warp of wire is twisted so as to shift the preferred direction of magnetization from a longitudinal to a helical path. There is a twist between each intersection. The coincidence of a helical field and a circular field puts information into the system; the magnetic wire is the sensing means.

Present core systems, used in almost all large-scale computers, can operate on a cycle time of 8 microseconds, switching in about 1 microsecond. Projected systems will need to switch in 0.1 microsecond or less in order to match cycle times of half a microsecond.

Heat, caused by eddy currents and hysteresis, is the big limitation on speed of magnetic components.

It's a less serious problem in memory systems than in processing circuits.

III. Ferroelectrics

Use of ferroelectric devices will be pretty much limited to memory systems. Like ferromagnetism, the ferroelectric phenomenon does not readily supply gain.

Ferroelectrics will give much greater memory capacity in smaller space than even magnetic cores. They can also be used for the switchgear controlling the storage.

Theoretically as many as 10,000 separate memory cells can be placed in a single square inch of thin ferroelectric "sandwich." Probe size limits this packing density. Each cell has to be probed by a mechanical contact, and even fine wire can't easily be packed 10,000 to the square inch.

Research in ferroelectricity may solve a couple of other limiting problems. One is that eddy-current heating puts a 100-kc limit on frequency response.

But the ferroelectrics can switch states in 7 millimicroseconds, just so you don't do it too often. This makes them ideal for low-speed high-capacity storage systems.

IV. Cryogenics

Tiny cryotrons are the great white hope of the computer industry. They're cheap, small and reliable. They can do anything: the superconductive phenomenon can be used in one way for gating, switching and amplifying, in another for memory systems. And they're probably about five years away.

Research aims to uncover new facts about supercooled thin films

Effective upper frequency limit of cryotron amplifiers and switches will probably prove to be in the neighborhood of 500 mc. Above this level it may be difficult to keep the tiny components cooled to the temperature of liquid helium or nitrogen because of eddy currents.

The cryostat, the device that keeps the components supercooled, is another limitation: it doesn't lend itself to rough environments. And the day when you'll see thermoelectric cooling to 2 degrees Kelvin is not just around the corner.

Cryogenics engineers speak of the day when all the complex circuitry of a computer can be put inside a Dewar flask. Miniaturization is not just a catchword in this field; it's necessary. Efficiency of the cryotron is increased by thin films—a few thousand Angstrom units thick—because of increased ratio of resistivity to inductance.

V. Microwaves

The idea of computers operating in the microwave spectrum, from 100 to 100,000 mc, is one that excites the computer builders—and brings despairing looks to the engineers that have to design the things.

First practical microwave computer circuits will probably use travelling-wave tubes as amplifiers, two-dimensional circuits, some high-frequency transistors.

Solid-state supercooled maser has provided one good answer to microwave amplification. The maser, a narrow-band low-noise amplifier in the microwave spectrum, is quite small in size (although it needs a magnet and a cryostat to provide control field and liquid-helium bath).

Rethinking the logical organization of computers should mean more efficient circuitry capable of performing logical operations right in the plumbing—adding in coaxial stubs or gating in magic-T's.

One hot project, which only the development of narrow-band amplifiers like masers would have permitted, is a decimal computer. Such a machine would treat decimal values instead of pure or coded binary values, could easily mean at least a threefold increase in processing speed.

This in turn relies on a different method of modulating the data onto the carrier. Instead of pulsing the carrier, microwave engineers think in terms of phase or frequency modulation.

The decimal adder of an f-m computer would have its operating channel divided into 19 bands, each representing one of the possible sums—0 through 18—of adding two single digits. Masers, with their 1-mc bandpass, could operate neatly as discriminating amplifiers for each of the 19 bands in a 40-mc basic channel-width.

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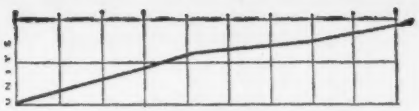

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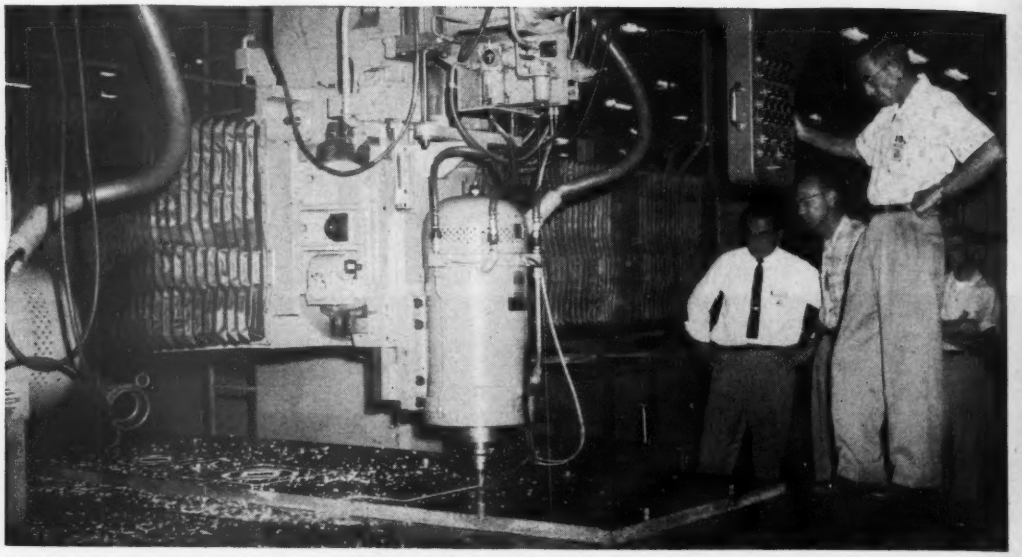
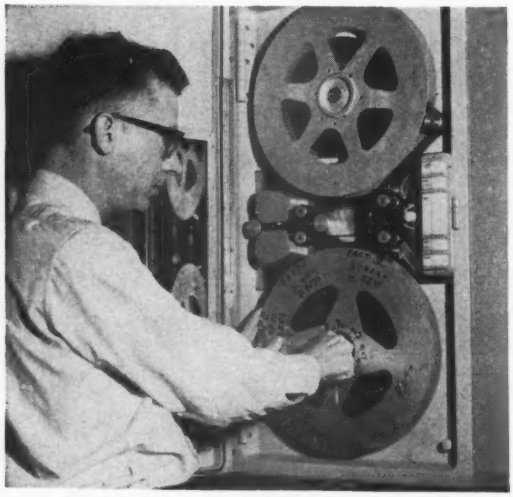


Vital airframe parts of the Titan ICBM will be produced on this spar and skin miller. Above, the miller traces geometric design in a check-out at The Martin Company's missile plant in Denver, Colo.

Numerical Tool Control Pushed

Spotlight centers on huge, costly three and five-axis airframe contouring machines sponsored by Air Force. Machine tool builders see future mass market for simpler positioning machines which can be directed without computers.



Technician installs roll of plastic tape in command console of skin miller at Lockheed Aircraft. Tape holds milling instructions for several parts

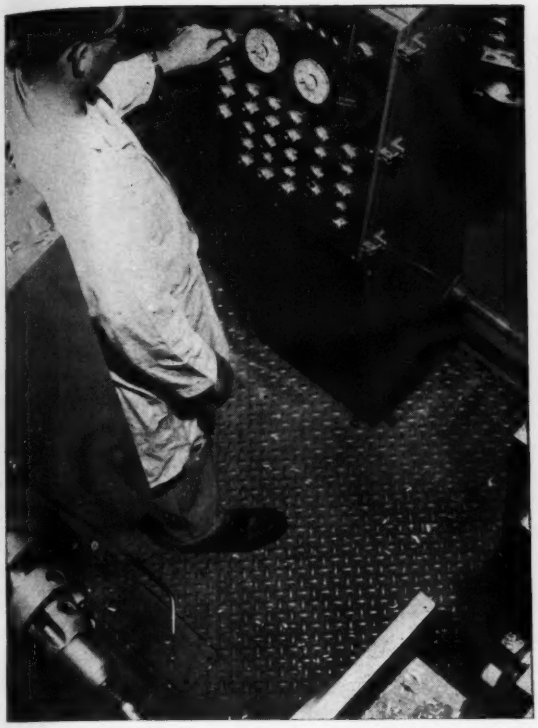
OPERATING MACHINES by numerical control is off to a flying start—right at the top rung. Impressive examples are shown here: big, expensive computer-directed, three and five-axis airframe contourers.

But behind these, a lot of smaller machines are coming into production. About three dozen firms here and abroad are readying numerically-controlled tools.

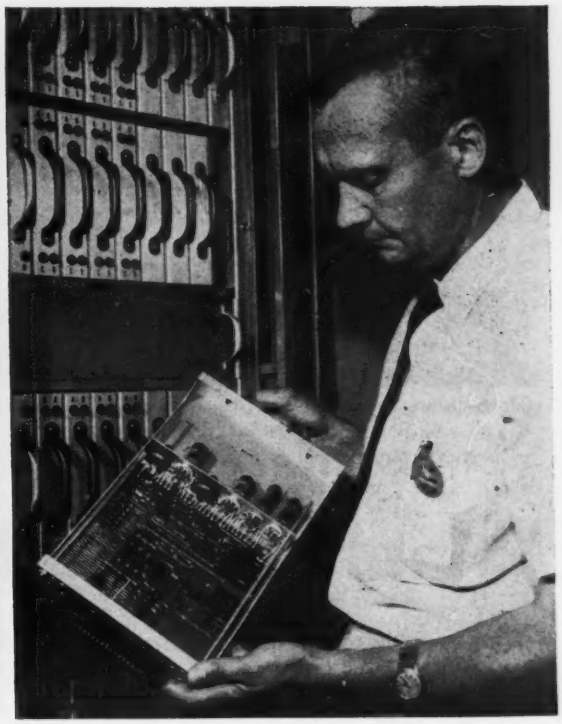
Many of the new machines will be the millers, borers, grinders, presses, lathes, drills and riveters suitable for small metalworkers. It is estimated that 1.7 million of the machine tools now in use could be improved with numerical controls.

Directions for straight cutting and two-axis positioning—ample for most machine tools—can be prepared easily and inexpensively on punched tape or other guides.

Even if a tool buyer requires a contouring machine, he can now avoid the sometimes prohibitive cost of a computer-director. General purpose computers



Operator only has to flick a few switches at control panel of profile and contour miller at Northrop Aircraft. Tape guides cutting tool's complicated bath



Bendix Aviation's profile miller control center uses self-checking circuit packages. Package construction permits repairs without interruption of production

may be used or director services rented from tool machine builders.

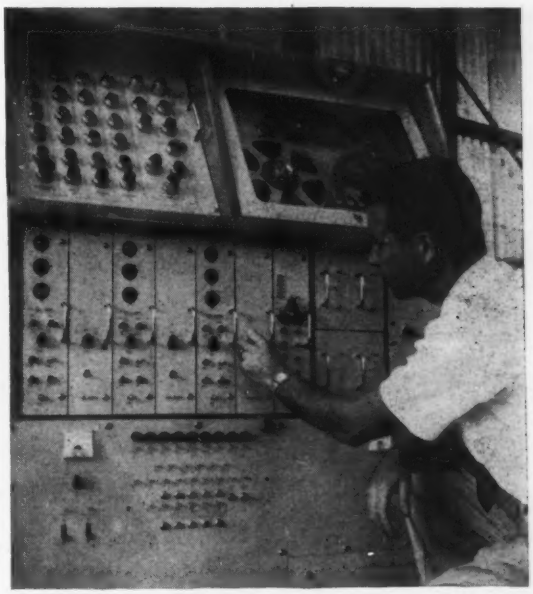
Some of the big computer-directors cost over $200,000; control consoles, $25,000 and up. But the positioning machines can make do with inexpensive tape punchers and control systems costing under $10,000.

The same reasons that led the Air Force to bankroll numerical control development is expected to put it into every metalworking industry in five years.

Air Force wanted to overcome the "producibility barrier" caused by airframe complexity. Its investment paid off in machining economy and parts uniformity three to 10 times as good as conventional contouring.

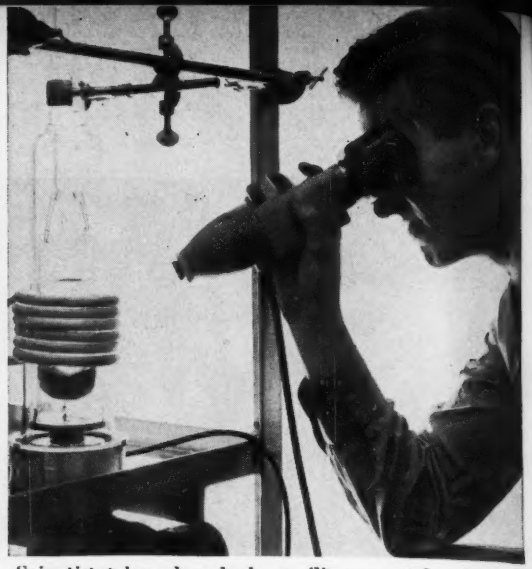
Initially, Air Force ordered 35 machines. Now, 105 are to be installed by 1959 in aircraft and missile factories. The cost is about $30 million, of which one-fourth represents the directors and controls.

Machines for the program, according to the Air Force, are made by Cincinnati Milling Machine, Giddings & Lewis, Kearney & Trecker and Morey. Controls are being manufactured by Bendix, Concord Controls, Electronic Control Systems and GE.



Control Console for vertical profiler goes to Convair. Command signals through magnetic amplifiers drive machine, feedback guards against cutting errors

Materials are tested under near vacuum condition. Variety of basically new electronic materials with unique properties are made and tested



Scientist takes close look at silicon crystal growing in induction furnace. Researchers seek new materials with favorable electronic characteristics

What's Doing In USAF Labs

Radar group at Cambridge Research Center digs into fundamentals of detection, concentrates on reproducing ionospheric environment

Scientific teams explore 'unorthodox' designs for tactical-aircraft systems, seek new materials, probe speech compression, antijamming

AIR FORCE'S EXPANDING INTEREST in outer space is reflected in a "new look" at the Electronics Research Directorate of the Air Force Cambridge Research Center, where current and planned projects range from celestial radio mapping to reproducing ionospheric conditions in the laboratory.

ERD at Bedford, Mass., is the primary agency responsible for basic research and technical development in electronics for the Air Force. In fiscal 1957, ERD spent about $16½ million on this job, and it looks like the total will swing upward in 1958.

Lattice structures of ferrimagnetic and ferromagnetic materials grown in ERD laboratory are examined by William Field, chief of magnetics section. Significant advances in electronics are expected largely through development of materials with unique electronic properties

One-quarter of ERD's work is done "in house"—at the laboratories in Bedford—and three-quarters by contractors, industrial and academic.

The facility employs 482 persons, mostly civilians. There are 28 PhD's among the 247 professional people, including Lowell M. Hollingsworth, the director.

ERD's Radar Laboratory has embarked on a new space-age program. Instead of trying to develop bigger and better radar components and systems, in-house and contracted projects will concentrate on the fundamentals of detection—particularly under environmental conditions similar to those in the ionosphere. Plasma physics will be explored.

Radar Laboratory personnel are looking into:

Means of producing ultrahigh temperatures and study of phenomena under these conditions.

Vacuum and electron physics, with emphasis on emissivity of materials, electron dynamics, gaseous physics and development of vacuum and gaseous devices for laboratory use.

Interaction of microwaves and plasmas, and development of microwave probing and testing techniques.

Principles which govern detection of objects by emitted and reflected electromagnetic energy under various environmental conditions.

Propagation Laboratory projects include an expanded radio and radar astronomy program, in addition to tropospheric, ionospheric and meteor scatter.

An extensive simulation program is underway at ERD's Computer Laboratory. A simulation device built by Columbia University for the directorate and described as "one of the most sophisticated" developed to date, provides realistic radar data to feed into computers, eliminating the need for expensive test aircraft.

"The data is more useful than live information," says Charlton M. Walter, chief of Simulation and Evaluation Section, pointing out that the position of target aircraft and other important parameters cannot be accurately controlled or measured in flight tests. With the simulator, each parameter can be closely observed and accurately controlled.

ERD is also working on improved methods of computer storage, particularly to shorten readout time. One technique under development uses "thin films," layers of oxide material for data storage. Also, an electroluminescent type of phosphor as a storage medium promises to cut readout time. The Computer Laboratory has 40 contracts for research.

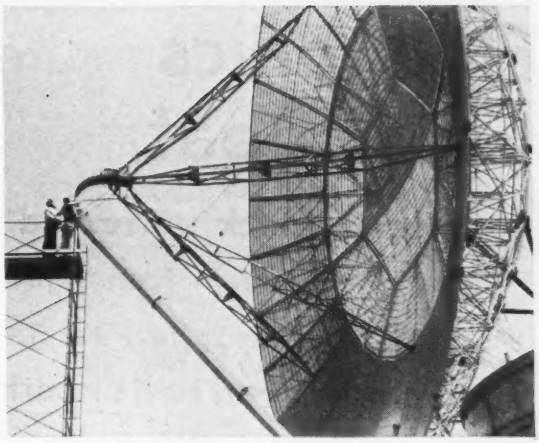
Design of improved airborne and ground antennas is the goal of ERD's Antenna Laboratory. This lab is using scaled models of aircraft and missiles to get radar cross-section measurements. Experiments will provide "radar patterns" for each type of aircraft and missile target.

The laboratory is also working on three-dimensional radar, a project which remains classified as to details. It is expected the system will eliminate the need for separate height-finding and will give simultaneous data on height, range and azimuth.

Airborne work includes tests on a flush-mounted type of antenna, which would be an integral part of the skin of a plane or missile.

In conjunction with MIT's Lincoln Laboratory, ERD is testing new air-ground communications. In experiments to date, using B-29's, B-50's and B-47's, fields have been measured to 1,500-1,800 mi. The Air Force recently assigned a KC135 to Bedford for more tests.

The Communications Laboratory is doing advanced experimental work with "speech compression" equipment which will transmit vocal messages using about 500 basic speech sounds or patterns. Digits are automatically assigned to each pattern, and these are sent to the receivers, which decode the digits and reproduce the message by use of a synthetic voice. In this way, the band width needed to transmit voice will be reduced by a factor of 10.



Scientists of ERD Antenna Lab check out new antenna before it is shipped to the Air Development Center in Rome, N. Y.

Theoretical studies are underway by the Communications Lab on antijamming. Goal is a system which "skips around" randomly—using various frequencies to overcome jamming.

Nearing the end of a five-year research and development cycle is the Special Systems Laboratory's Tactical Air Control System. Designed to replace the Tactical Air Command's manual-voice system of the Korean War (and growing directly out of limitations of tactical air control shown by the war), the TAC system will automatically control tactical aircraft on interdiction and interception missions.

The system is one of a class—of which SAGE is the archtype—known as semiautomatic electronic ground environment systems. They link radars, communications, and commuting gear into a single, integrated network covering relatively big areas.

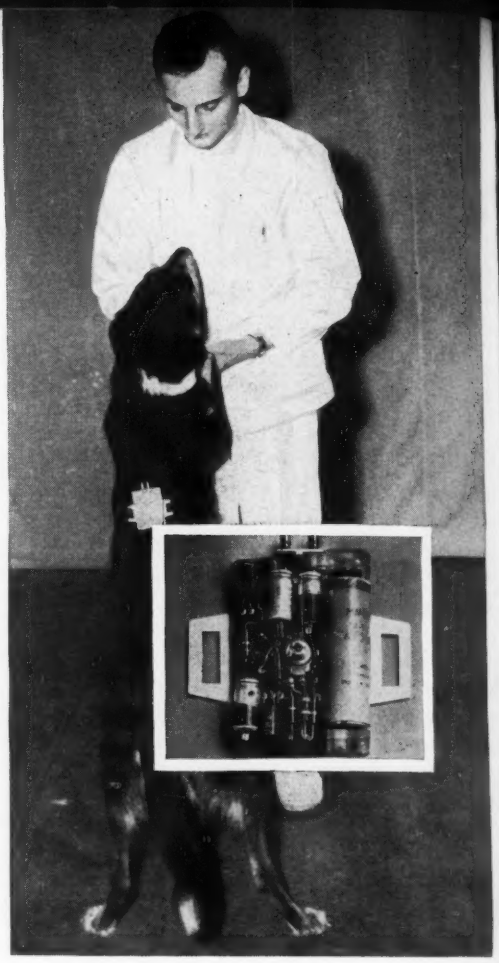
The air control system itself—highly mobile for use close to battle lines—was tested extensively last Summer by the Tactical Air Command at Shaw Field, S.C. Sperry Rand is now building the first equipment for installation of the system.

Materials research is primary object of ERD's Components and Techniques Laboratory. It is doing extensive work on ultrahigh purification of materials, such as silicon; thermal and radiation damage to electronic components; and experimenting on silicon carbide transistors.

Research teams are also interesting themselves in ferrites, masers, and various garnet-structured materials, attempting to grow or make basically new materials with favorable electronic characteristics.

Electronics Gives Beat

Heart block corrected, dog with tiny transistor amplifier bandaged to its back and wired to its heart frolics with doctor



ARTIFICIAL STIMULATION OF THE HEART by electrical impulses from an amplifier recently enabled doctors to perform the first successful correction for heart block in medical history.

Heart block is caused by destruction of the nervous connection between a heart's auricle and ventricle chambers. Normally, the auricle produces electrical impulses which trigger the ventricle, causing it to contract. This forces venous blood into the lungs and aerated blood into the arteries.

If the nervous pathway is broken, the ventricle beats at an independent and much slower rate. Since the natural rhythm of the ventricle is not rapid enough to supply sufficient circulation, the slightest exertion causes the patient to faint.

To study heart block, surgeons at the Children's Medical Center in Boston developed an operation which artificially created the condition in a dog. After the operation, the dog behaved typically; that is, he moved slowly, stood with difficulty and took a long time to eat because the heart was unable to supply the extra circulation required for digestion.

A blocked ventricle can be stimulated and made to contract by brief application of a voltage to a pair of electrodes contacting the ventricle wall. Early last year, Dr. Folkman of Children's Medical Center and Dr. Watkins of Harvard Medical School thought of sewing pickup electrodes on the auricle, amplifying the pulse produced by the auricle, and applying the amplified pulse to the ventricle.

G. F. Vanderschmidt, an electronics consultant, developed a simple, R-C coupled, two-transistor amplifier. It is capable of amplifying the 5-millivolt auricle pulse into the 0.5-volt pulse necessary to induce contraction in the ventricle.

The dog whose heart had been artificially blocked was used in the experiment. When the chest was opened, the auricle of the exposed heart was seen to beat rapidly while the ventricle filled with blood very slowly and contracted only once every 10 sec.

Electrodes were sewn to the right auricle and right ventricle. Special polyethylene-coated stainless steel wires linked the electrodes to the amplifier.

As the amplifier gain was increased, the two chambers immediately began to beat together. The dog recovered rapidly, wolfed his food, and frolicked around the laboratory.

The animal's behavior was entirely normal for several weeks. Subsequent improvement in technique has permitted dogs to live several months. Development of scar tissue under stimulating electrodes limits time period during which the method works.

At present, the technique offers emergency care throughout the critical post-operative period for patient's who develop heart block. In such cases, the heart often operates normally after the amplifier output has been applied for a short time.

This technique should open a new field for electronics firms, such as those presently producing hearing aids. Present need is for more refined stimulating techniques and for better methods of implanting devices inside the body. One idea suggested is to use potted transformer windings capable of supplying and receiving electrical information without feed-through wires.

ENGINEERING REPORT

Airships Now Sonar Platforms

LIGHTER-THAN-AIR CRAFT, long the stepchild of the Navy, have this winter quietly been carving out for themselves a new career as floating platforms for electronics equipment. The operational airship today carries tons of sonar and airborne detection equipment, including almost every type of detection and search device presently known.

With refueling, remanning and restocking operations now approaching perfection, the time is not distant when the airship station may be regarded as a permanent installation in the early-warning network.

MORE EFFICIENT METHODS for production and distribution of electrical energy are high on many research agenda today. One reason is that availability of fossil fuels (coal, gas, oil) is expected to fall short of requirements in next 10 to 30 years.

One answer to the problem may be the electrochemical cell developed by Horizons, Inc., which depends upon reaction of hydrogen and oxygen. The overall result is the formation of water plus two electrons, and a potential of about 1 v between the terminals. Another development is the increasing use of audio frequencies for electric power.

AN AIRBORNE RECEIVER design developed at Bell Aircraft is capable of integration with tracking-type ground radar. Proposed technique provides airplane with necessary lateral, elevation and range-to-go information for making final approach and touchdown along centerline of runway. Information is digitally encoded on beam of pulse-type tracking radar.

RECENT SELF-DESTRUCTION of Atlas test missile and speculation that stray r-f may have been responsible is refuted by J. K. Records of General Electric Co. He points out that electronic jamming of a radio-inertial guidance system, although theoretically possible, would be exceedingly difficult and expensive. Contrary to popular understanding, he says, it would be about as easy to sabotage the missile on its launching pad as to jam its guidance system after takeoff. As a practical matter, the number of jamming stations required and the short time in which they would have to work makes radio-inertial guidance virtually invulnerable.

TECHNICAL DIGEST

• **Transistorized** galvanometer serves as null detector having resolution of 10^{-9} ampere and sensitivity of 0.05 μa for full-scale deflection, while using relatively rugged 50-0-50 μa moving-coil instrument. Design of Ferguson Radio Corp., Ltd., uses five OC44 junction transistors as highly stable d-c amplifier using balanced long-tail pairs, with operating points stabilized at low voltage and current levels. Transistors are wrapped with copper foil to fit tightly in mounting holes drilled in brass or aluminum block to further minimize zero drift.

• **Projection kinescope** control system for facsimile scanner uses multiplier phototube, positioned to intercept portion of light striking projection lens, to actuate automatic light control circuit that changes grid bias on kinescope so as to keep intensity of flying spot essentially constant. Royalty-free license for U. S. patent 2,804,550 on circuit is now available from AEC.

• **Sampling oscilloscope** developed at Brookhaven for AEC displays single transients having either constant or random repetition rate, for testing fast photomultiplier tubes used in nuclear particle detection. Fractional-microsecond delay permits triggering from front edge of pulse being observed. Time jitter generally associated with random pulse heights is eliminated by selecting only pulses falling within kicksorter channel. Trace will rise from 10 to 90 percent of correct height in 5.6×10^{-10} sec.

• **Airborne cryostat** weighing only 45 lb provides −196 C temperature of liquid nitrogen for cooling infrared-sensitive photoconductor grids in detector heads used in aircraft or guided missile installations. Design by Perkin-Elmer utilizes Joule-Thomson effect with principle of regenerative cooling in totally enclosed system. Small cooling head fits into standard lead sulphide and similar detector units, and in missile systems may be connected by umbilical tubing to pump and regulator in mother aircraft up to the time of firing.

• **Scaler using unique** fast flip-flop circuit, developed at Radiation Lab of University of California, can be triggered at rate above 50 mc and has double-pulse resolution of 20 millimicroseconds. Fast switching is achieved by modifying Eccles-Jordan trigger circuit to have high loop gain, low output impedance and short time constants, along with clamping techniques that contribute also to stability. Tube used as flip-flop is 6BS8.

Data to position aircraft image correctly on forty-mile diameter tv map comes from a navigational computer

Pilots Get Tv Map

Ownership position superimposed on television map simplifies navigational job for pilot

AIBRORNE closed-circuit television is used in a system that pictures constantly for the aircraft pilot the exact location of his plane in relation to the ground.

The system is called the horizontal situation display. It correlates information fed into it by navigational computers and instruments and presents a tv picture in the form of a map of the terrain below the plane. A plane image, projected over the map, corresponds to the pilot's position over the terrain.

The system was developed by Avion division of ACF Industries under contracts by the Weapons Guidance Laboratory at Wright Air Development Center.

Navigational computers have taken over the complex job of determining a plane's true course, speed and location. However, the pilot or a crew member had until now to take the numerical information supplied by the computers and put it on a map before the pilot could determine exactly where he was in relation to his home base or destination.

The horizontal situation display relieves the pilot of this chore. On a five-inch round tv screen mounted on the instrument panel, the system shows an image of his plane superimposed on an aeronautical map.

Signals from a navigation computer are fed into the system. These signals actuate controls governing the position of the map and plane image in relation to each other. The result is picked up by the tv camera, located in a remote part of the plane, and transmitted to the cathode-ray tube on the instrument panel where it can be viewed by the pilot.

One advantage of the system is the unit map concept, where a map of the entire United States can be reproduced in detail on a single glass plate three by four inches. When viewed by the pilot, only enlarged portions, to the scale of the standard Air Force jet navigation chart, appear on the cockpit screen.

The system is equipped to provide two magnifications. Thus the pilot can view a detailed area of approximately 40 miles in diameter or a larger area of 120 miles.

The system only requires that preliminary settings be made when a new chart is inserted in the remote plotter unit. This is done before take off. Once the map is in place and the initial latitude and longitude information is included, the plotter requires no further setting.

The pilot has other controls to make either the map or the plane image move, to reposition map and plane marker, and to control brightness and contrast of the picture tube.

The heart of the equipment is called the plotter and electronic unit and is contained in two remotely located packages. Together with the tv tube mounted on the instrument panel, the total weight is less than 45 pounds.

Electrons May Solve Reentry Problem

MAGNETOAERODYNAMICS may provide the means for safely returning rockets and satellites to the earth. How this might be accomplished was described at the National Academy of Sciences by William H. Sears, director of the Graduate School of Engineering at Cornell University. Further research in the field may also lead to a tremendous increase in the thrust of conventional rocket motors.

Magneto-aerodynamics is concerned with the partial ionization of air that occurs when objects pass through it at extremely high speeds. Rockets and satellites during reentry into the earth's atmosphere result in such ionization.

Friction and compression heat the air in front of the object to a very high temperature causing it to ionize and become a conductor of electricity.

This conductivity can be increased by seeding the air near such a high-speed body with a small amount of easily ionized substances such as sodium or potassium, the Cornell research indicates.

If this technique can be worked out and if magnetic strengths comparable to those of permanent magnets can be provided in flight, electric currents can be set up by the

relative motion of air and missile.

A satellite reentering the atmosphere at high speed will resemble an electric generator. The hot seeded air, which is a conductor of electricity, takes the place of the windings of the generator armature. The magnetic field will supplant the generator's fixed field. As the satellite plunges back into the atmosphere, the moving of this hot-air armature across the magnetic field of the satellite will generate an electric current. The resulting retarding effect could be used in slowing the satellite or rocket.

A possibly more interesting application of the principle could increase rocket thrust. The result would be obtained during acceleration rather than deceleration. But to do this will require the use of electric fields as well as magnetic. If an electric field can be applied across hot seeded air by means of electrodes, a current will flow. The combination of a current and a magnetic field gives rise to a force which can be directed so as to accelerate rocket to speeds theoretically unlimited.

There are many difficulties to be overcome, however. The most obvious pointed out is the provision of strong magnetic fields. Seeding techniques need to be worked out; the surface resistance of cold electrodes in contact with hot air must be reduced sharply. However, Dr. Sears believes that the amount of research required is justified.

Infrared Collision Warning Proposed

PROBLEM of collisions between airplanes gets a proposed solution from Minneapolis-Honeywell. M-H suggest to the Air Transport Association an infrared system instead of one based on radar.

Despite the advantage of all-weather operation, radar was eliminated because of size and cost. A factor in choosing infrared is its short wavelength, which makes possible a system of very accurate angular resolution.

The passive-detection feature of infrared was also found wanting. Maximum range was felt to be insufficient, although long-range development work with some of the newer detectors might eventually solve the range problem. But passive infrared detection from an object as large as an aircraft would provide insufficient angular resolution.

A cooperative system was proposed. But it would still respond to noncooperating aircraft in the passive sense. The passive mode would have limitations but would enable the pilot to eliminate consideration of nearby aircraft that do not pose a threat.

The addition of beacons on cooperating aircraft could aid the pilot directly by supplying coded information regarding relative bearing. In addition, the point source of infrared energy would greatly improve angular resolution.

Yes and No

Azimuth and elevation (nodding beam) antennas are mounted on 65-foot towers at Burrough Corp. Research Center in Paoli, Pa. Antennas are for radar that will be used to test a coordinate data transmission device under Air Force sponsorship. Transmission equipment is for use in the SAGE system

MEETINGS AHEAD

MARCH

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APRIL

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MAY

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Mar. 8: American Society for Quality Control, Toronto Section, Forum: Basic Training in Statistical Quality Control, contact Treasurer, Box 7, Toronto 15.

Mar. 17-21: 1958 Nuclear Congress, Engineers Joint Council, AICE, and Atomfair, Atomic Industrial Forum, International Amphitheatre, Chicago.

Mar. 24-27: IRE National Convention, All Prof. Groups, Waldorf-Astoria Hotel and N. Y. Coliseum, N. Y. C.

Mar. 31-Apr. 2: Instruments & Regulators Conf., PGAC, ASME, AICHE, ISA, Univ. of Delaware, Newark, Del.

Mar. 31-Apr. 2: Southwest District Meeting of AIEE, Mayo Hotel, Tulsa, Oklahoma.

Apr. 2-4: Conf. on Automatic Optimization, PGAC, ASME, AICHE, ISA, Univ. of Delaware, Newark, Del.

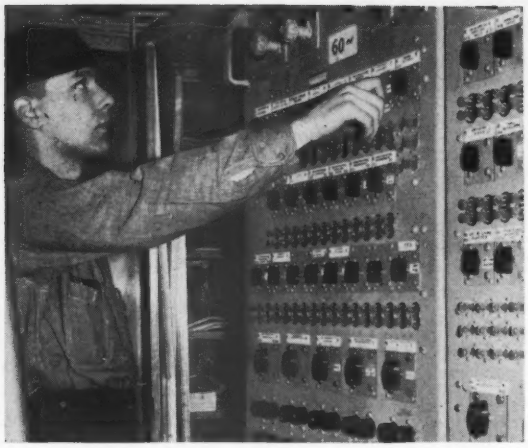
Apr. 8-10: Symposium on Electronic Waveguides, Microwave Research Institute of Brooklyn Polytechic Inst., held at Engineering Societies Bldg. N. Y. C.

Apr. 10-12: Tenth Southwestern IRE Conference and Electronics Show, St Anthony Hotel and Municipal Auditorium, San Antonio, Texas.

Apr. 14-16: Conf. on Automatic Techniques, IRE, ASME, Statler Hotel, Detroit, Mich.

Apr. 17-18: Second Annual Tech. Meeting, Institute of Environmental Engineers, Hotel New Yorker, N. Y. C.

May 6: Western Joint Computer Conf., First National Symposium on Modern Computer Design, Ambassador Hotel, Los Angeles.



High precision inertial navigation equipment like the distribution board for the computer room (left) and the latitude-longitude plotter (right) shown installed on board the USS Compass Island will play an essential part in . . .

Guiding Nuclear Subs

"THE MOST ELABORATE navigation system ever to go to sea" will guide the three atomic-powered, Polaris-launching subs with a precision never before achieved in an operational ship.

Fourteen months of evaluation on board the *USS Compass Island*, experimental forerunner of Navy's ballistic-missile launching vessels, has convinced the Navy that Sperry's SINS (Ship's Inertial Navigation System; ELECTRONICS, Jan. 20, '57) is capable of pin-pointing a submarine in midocean with sufficient accuracy to launch an IRBM.

Basically an inertial system, SINS senses, measures and remembers all movement from the moment it leaves port until it returns. Computers reduce the "motion" data, correlating it with elapsed time, to such navigational information as ground speed, course, heading, drift angle, distance from departure, distance to destination and continual geographic coordinates.

Master mind of the system is the Navigation Data Assimilation Center (Navdac). Data from a wide variety of auxiliary navigational devices that check and recheck each other, as well as the SINS, are fed into the digital computers in the Navdac. Drift error that accumulates in any inertial system with time is corrected automatically in both the SINS and in the dead-reckoning navigation readings maintained by the SINS.

A high percentage of auxiliary gear taken out on the *Compass Island* 14 months ago for evaluation has proved sufficiently accurate to remain a permanent part of the SINS. Included are:

- Sperry: course-keeping control, depth-keeping control, depth detector, integrated control systems with pictorial display, electromagnetic logs (see photo), a star tracker and a device that measures the speed of the ocean current transverse to the direction of the ship. Sperry also will install a new type gyro stabilizing device, different from the Gyrofin.

- GE and BuShips: sonar that measures the ship's ground speed.

- Burroughs: an underwater electronic device to determine and indicate the ship's speed through the water.

- Lamont Institute: an electronic device that determines speed over the ground.

- Naval Ordnance Laboratory: an accoustic correlation system for observing the ocean bottom.

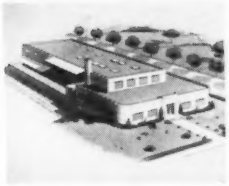
- Ferrand Optical: optical tracker as well as a horizon follower—a fine-line tv telescope for looking at the horizon in several directions at once.

- Electronics Corp. of America: telescope with improved infrared detectors.

- Collins: radiometric sextant which will line up radio transmissions coming from the sun or moon as an optical telescope lines up light. (ELECTRONICS, June 10, '57).

- Detroit Controls: a radiometric sextant for use with radio stars.

- Reeves: a complete star tracker.



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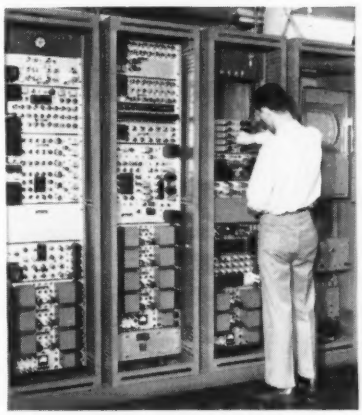

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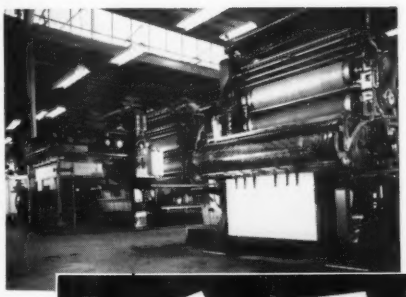

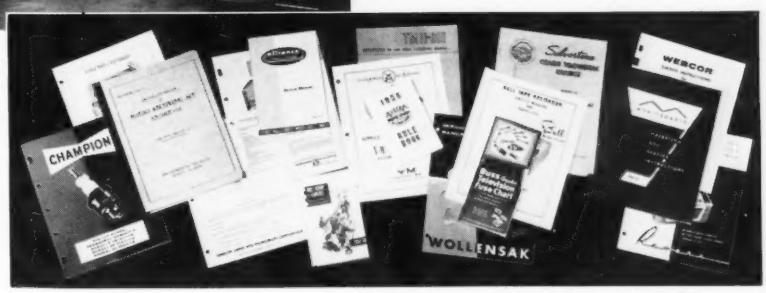

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Insulated metal tubular capacitors are available in all popular ratings, with choice of insulated or uninsulated wire leads or solder eyelet terminals at either or both ends. Uninsulated metal tubular units are also available. (Unit above is shown actual size.)

Competitively priced units made with 99.99% pure aluminum foil

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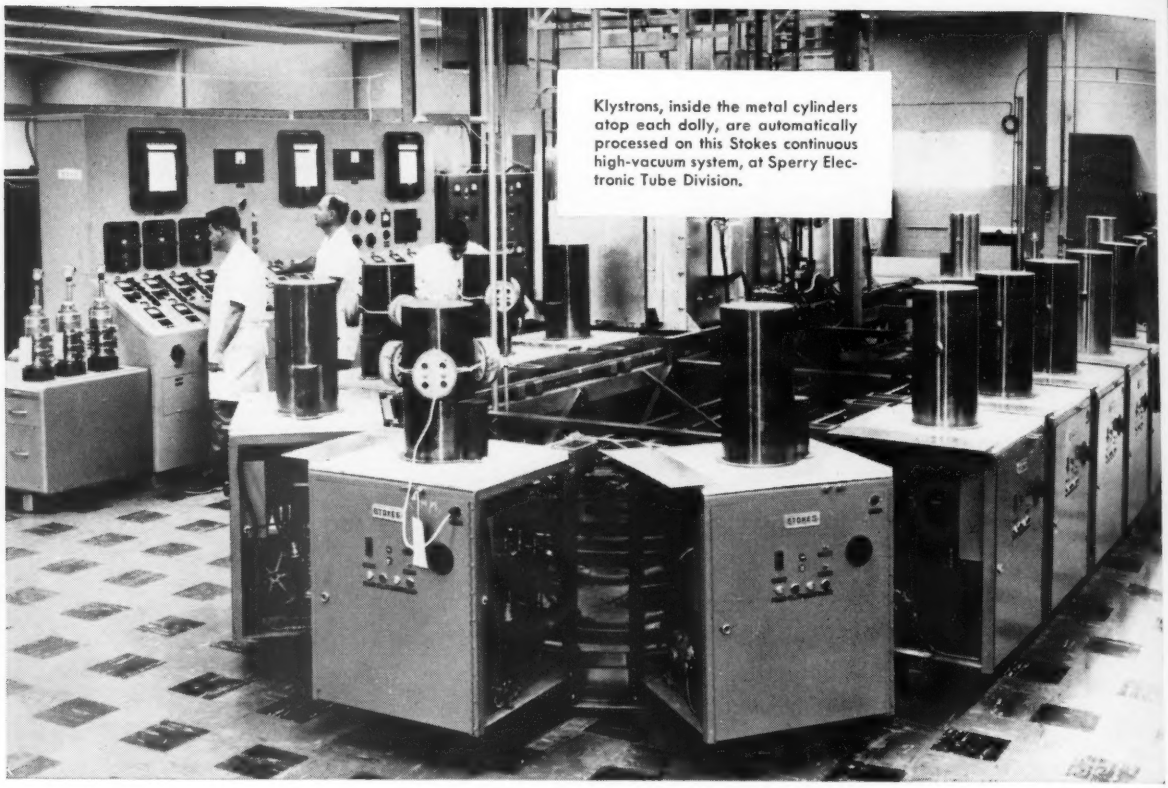

Klystrons, inside the metal cylinders atop each dolly, are automatically processed on this Stokes continuous high-vacuum system, at Sperry Electronic Tube Division.

Klystron production automated with Stokes high-vacuum system

THESE Sperry Klystrons have *got* to be rugged and stable . . . they're the heart of transmitters for precision, all-weather navigation systems. Producing Klystrons requires extremely high vacuum and elevated temperatures to completely de-gas and dry the tubes internally. These conditions must be attained on a high-production, automatic basis.

Stokes, pioneer in high-vacuum processing equipment for the electronic industry, designed and built a continuous evacuating and conditioning system that performs these functions and eliminates the need for duplicate accessory equipment for each of the separate units formerly used. The system consists of an endless loop of evacuating stations, each housed in an individual dolly. As the dollies index around the loop, the tubes are successively degassed, evacuated, aged, conditioned and sealed.

Each Klystron is enclosed in a stainless steel bell in which a reducing atmosphere is maintained to prevent oxidation of the copper tube body during the heating cycle. All operations are automatically sequenced and controlled, with interlocking circuits and limit switches giving added protection. Any dolly can be removed and replaced without shutting down the system.

This Klystron production system is an example of how another major manufacturer is benefiting from Stokes' long experience in high vacuum engineering and automatic production techniques. For a consultation on your specific needs, call your nearest Stokes office.

Vacuum Equipment Division
F. J. STOKES CORPORATION
5500 Tabor Road, Philadelphia 20, Pa.

STOKES

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CIRCLE 23 READERS SERVICE CARD

Transistors: 600 Types

As sales double in year, so does number of kinds. Manufacturers travel path towards packaging standardization

PERHAPS IT IS just coincidence. But while transistor sales showed a 100 percent increase during the past year, the number of commercially available types also doubled.

A year ago, about 250 to 300 types were on the market. Now there are about 600 kinds in production. If obsolete types are included, the count approaches 750.

Since the two dozen transistor manufacturers are not likely to slacken efforts for a wider product line, the statistics imply a need for as much standardization as possible.

Recognizing this, Electronic Industries Association and the individual manufacturers are well into a voluntary program which is already eliminating some of the differences in transistor packaging.

The program has two aims. It will nip in the bud the confusion that could come from helter-skelter product development. It will also add to the usefulness of transistors by affording interchangeability in replacement, automatic assembly and design.

A number of transistors are being packaged, or repackaged in conformance with Joint Electron-Tube Engineering Council specification 30. An EIA spokesman says there has been some misunderstanding that JETEC 30 was to become the required packaging.

Any packaging plan is voluntary. Moreover, JETEC 30 actually began as a group of size suggestions drafted as part of EIA's standardization study and was not intended to become the last word.

More permanent, but still voluntary, dimensions for cases and lead placement are being specified as so-called "Transistor Outlines." Some 10 TO's have been registered with EIA.

In addition, an EIA subcommittee is preparing parameter data sheets. These forms would give transistor buyers a uniform method of comparing characteristics of various transistors.

Circuit Market Leveling?

PRINTED CIRCUIT manufacturing growth may be leveling off. At least this is the finding of a survey conducted by the Institute of Printed Circuits, an organization of independent fabricators of custom circuit boards.

IPC estimates that custom manufacturers are currently competing for a $10.4-million market. Sales during 1957 were about 10 percent over 1956. The second half of 1957 ran only six percent ahead of sales in the last half of 1956. From 1954 through 1956, the average second half gain was 95 percent.

The leveling off, IPC says, was accompanied by the passing of many firms with limited experience and capital. In addition, some larger component firms dropped out because of slim profit margins. Probably only one-fourth of the 200 listed printed-circuit manufacturers are seriously in the business.

In the IPC survey, reporting firms indicate that raw materials expenditures account for 52 percent of selling price on commercial type circuits and 22 percent on smaller quantity military, instrument and industrial type runs. Custom manufacturers are making 43 percent of the panels used in commercial applications and 70 percent of the military and industrial panels.

The survey bears out predictions made by manufacturers early last year that there would be both growth and attrition during 1957 (ELECTRONICS, May 20, '57).

King Size

Latest claimant for title of world's largest printed circuit is this 48 by 22-in. board made by Packard-Bell for North American Aviation. Three such boards are laminated together for use in missile checkout equipment. The three-board unit contains a half mi of printed wiring and 1,600 terminals staked into plated through-holes. It substitutes for a large portion of a cabling system

Plastic Radomes Take 500-2,500F

HOW TO BUILD radomes to withstand aerodynamic heating and rain erosion on high speed aircraft and missiles was among topics at the Society of the Plastics Industries Reinforced Plastics Division session in Chicago.

Research now in progress, much of it classified, is subjecting improved reinforced plastics to temperatures as high as 14,000 F. That is hot enough to vaporize any known material.

Goodyear Aircraft researchers reported that one of their Fiberglas laminates withstood short time exposure to 6,000 F, a skin temperature which is expected at hypersonic speeds.

Radomes built of phenolic or silicone Fiberglas laminates repeatedly took thermal shocks of 120 F per second to a maximum of 1,000 F. Sandwiches of this material, filled with inorganic beads coated with resin and powdered metal, operate at higher temperatures.

Radomes which are acceptable electrically and structurally are being developed for operation at 500 to 2,500 F, it was reported.

Navy Plans Heavy Buying

Big electronic purchases through 1959 are evident in Navy's atomic, missile-age construction program

NAVY'S BIG ATOMIC missile-age construction push scheduled to get even bigger during fiscal 1959 means billions of dollars in business for the electronics industry.

Though the Navy is tight-lipped about specific electronic system and subsystem details, a look at the procurement list calls to mind a large number of fundamental items that such a fleet can't do without.

Immediate plans call for three atomic-powered subs, each capable of carrying 16 of Lockheed's Polaris IRBM's. $296 million has been authorized by Congress as a supplemental appropriation for fiscal 1958 as a starter for the subs.

Weapons systems manager will be the Director of Special Weapons Projects, Bureau of Ordnance. Construction supervisor will be BuShips.

Two of the subs will be built by General Dynamics and one by the Mare Island Naval Shipyard. Estimated cost of the first sub lies between $105 million and $110 million. The next two will be about $15 million cheaper.

Much of the work will be handled by direct contract with the Navy as opposed to subcontracts through industry. Westinghouse has a $18.63 million contract for nuclear reactor components; GE will provide propulsion machinery under a $6,360,341 contract. Sperry will equip all three subs with its (SINS) Ship's Inertial Navigational System (see p 28).

First deliveries of both Polaris and the subs are expected in 1960.

Navy's construction plans for 1959 are bigger than for 1958. A proposal to Defense Secretary McElroy asks for six more Polaris-carrying subs. Estimated cost: $1 billion.

Besides this, after June 30, Navy will ask for 20 more ships, seven conversions, and for work to begin on components for an atomic-powered carrier.

The 20 ships include: five atomic subs (one for missiles and four for attack or antisubmarine missions), five guided-missile destroyers, six guided-missile frigates, one guided-missile nuclear-powered frigate, one amphibious assault ship, one amphibious transport dock and one ammunition ship.

Seven conversions: Two cruisers will be rigged to launch surface-to-air missiles; three landing ship dock vessels will become seaplane tenders; one mariner hull will be turned into an attack transport; and one submarine will be altered to accommodate better weapon offense.

Obvious requirements—and all in large quantities—for such a fleet include: internal and external communications, sonar, search radar, missile launching gear, electronic fire control, data reduction, computers, inertial, astro and other navigational equipment.

MILITARY ELECTRONICS

• **Pure inertial guidance** (A. C. Spark Plug) has successfully navigated the new jet missile Mace TM-76 (Martin) on two 650-mi flights. Predecessor to Mace is the radio-command controlled Matador. controlled Matador.

Long period of time the inertial components stayed within their tolerances—much longer than needed for a ballistic missile—speaks well for their precision.

• **Nevertheless,** "Inertial components are not accurate enough for a pure i-g to get a vehicle to the Moon," says Walter Haeussermann, Chief, Guidance and Control Laboratory, Army Ballistic Missile Agency. "Radar and/or astro orientation will be needed to correct the inertial system."

• **An airborne IRBM** to be carried in an atomic- or exotic-fueled bomber is being developed for USAF. Operational target date is 1963.

• **Electronic systems** for Bull Goose and Green Quail diversionary missiles (surface-to-surface and air-to-surface respectively) are being designed by Ramo-Wooldridge. Primes are Fairchild and McDonnell.

CONTRACTS AWARDED

Stavid gets a multimillion-dollar contract for production of additional guidance systems for the submarine-launched Regulus missile.

Collins will supply USAF with over $3 million worth of aircraft navigation equipment: $530,000 for airborne flight computer components; $820,000 for integrated airborne navigation instrument components; and $1,848,623 for Tacan components.

Sundstrand Aviation div. of Sundstrand Machine Tool will supply AMC with frequency-load control-

lers for the KC-135 tanker under a $3,483,830 contract.

Link Aviation will supply Ogden Air Material Area with modification kits for flight simulators, MB-5A and MB-5B, under a $189,857 contract.

Riverside Research Lab., div. of Motorola, gets a $329,590 contract with Army Signal Supply Agency for four passive homing drones, two passive drone seekers and four target radiation sources.

Penta Laboratories will sell electron tubes to Electronics Supply Office, Great Lakes, Ill., amounting to $387,720.

Remler will sell 136 amplifiers to BuShips totaling $217,878.

Lockheed gets $55,128,932 contract with BuAer for Navy's WV-2E radar sentinel aircraft. The antenna for the search radar, APS-70, is enclosed in an ellipsoidal radome measuring more than 30 ft in diameter. The radar was developed by Lincoln Labs and produced by GE. Hughes builds the antenna.

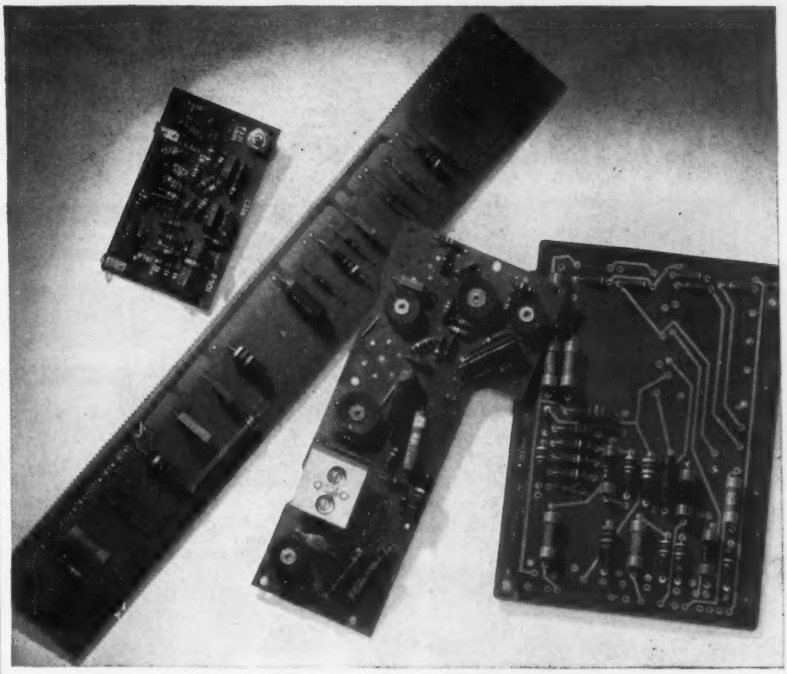
Aircraft Radio sells 1,645 radio sets, AN/ARC-60, to Army Signal Supply Agency for $2,024,483 and 795 radio receivers, AN/ARN-59, for $1,231,296.

American Machine and Foundry supplies Ogden Air Material Area with modification kits for 72 radar trainers, AN/APQ-T3, under $616,601 contract.

Aircraft Radio will supply BuAer with transceiver equipment, AN/ARC-39, under $446,068 contract.

Hoffman Laboratories will provide BuAer with technical assistance and instruction in the maintenance, repair and operation of aircraft electrical and electronic equipment under a $141,342 contract.

Ford Instruments gets two contracts with New York Ordnance District amounting to $404,619 for design and development of inertial devices.



DYNASERT®

Component Inserting

Economical for long or short runs, all board sizes

No. 1 Dynasert Component Inserting Machine Model B

Jumper Wire Inserting Machine Model B

No. 3 Dynasert Inserting Machine Model B

Dynasert users are finding mechanized component assembly practical for processing printed wiring boards in lots of 100, 75 — even as few as 20 a week!

There are two reasons why.

The first is *economy*. Mechanized assembly gives production rate advantages ranging as high as 8 to 1 over hand assembly.

The other reason users like Dynasert is *reliability*. They can count on uniform trimming, inserting and clinching without strain on component leads.

If you are now processing, bidding on or planning production that uses printed wiring, find how Dynasert can be of help.

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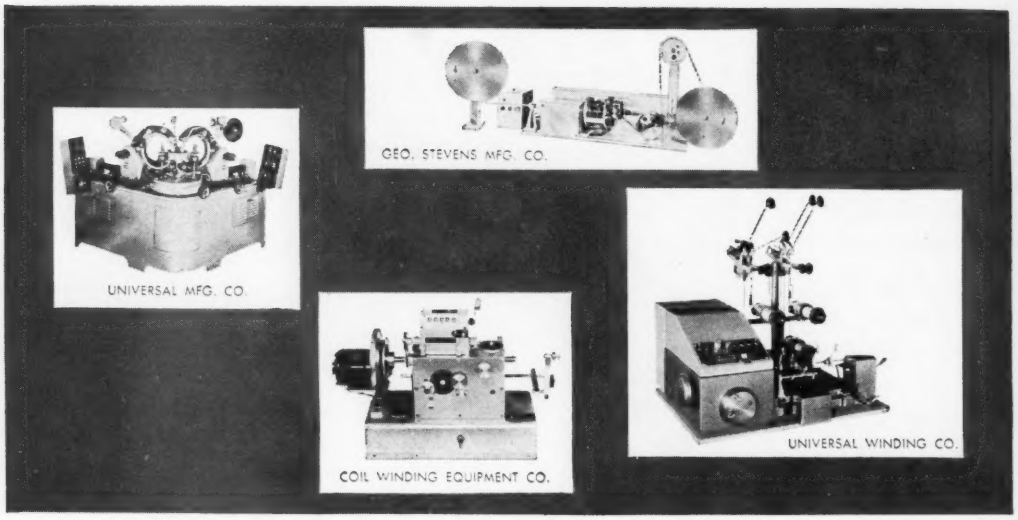


Cut Costs, Save Time

CONSTRUCTION of new plants, together with expansion of many already in operation, provides space and creates a demand for more production equipment. Output of winding machinery shows an uptrend.

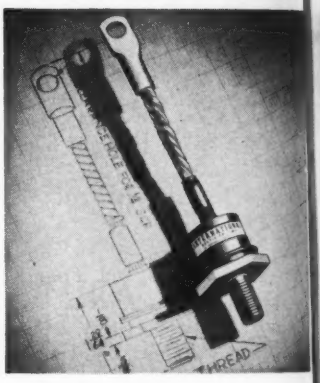
Universal Winding Co., P. O. Box 1605, Providence, R. I., (41) has available the No. 111 cross winder. It has a precision traverse system to produce extremely accurate cross-wound coils used widely throughout the industry. Coils can be wound singly or in multiple. The machine is also equipped with an electronic drive and many optional attachments to speed up production and reduce handling operations.

A new series of automatic dual-purpose toroidal winding and tapping machines has been introduced by **Universal Mfg. Co., Inc.**, 410 Hillside Ave., Hillside, N. J. (42). The Toroyd series UT machines feature simultaneous separate or sequential 360 deg continuous winding of wire and/or tape in one operation, and can be operated by one unskilled operator.

Coil Winding Equipment Co., Oyster Bay, N. Y., (43) offers models CX and CXS bobbin winders. They are an answer to frequent requests for machines of complete flexibility that do not require gear changing or frequent cam substitution. Complete adjustment of the wire feed without tools or loose gears or cams is possible. The three basic adjustments may be made with the machines running if desired.

Now offered by **Geo. Stevens Mfg. Co., Inc.**, Pulaski Road at Peterson, Chicago 30, Ill., (44), is a completely automatic continuous resistance winder which requires no operator. Model 209 winds resistance wire on continuous lengths of flat or round core material to be cut to any desired length and made into flexible wire wound resistors, attenuators, and the like.

For more information use READER SERVICE CARD



Silicon Rectifiers military type

INTERNATIONAL RECTIFIER CORP., 1521 E. Grand Ave., El Segundo, Calif., has available silicon power rectifiers designed to meet the rigid requirements of MIL-E-1 and MIL-T-19500-A. The IN412B, rated at 35 amperes rectified d-c output current with a piv rating of 100 v, has been approved under MIL-T-12679/26 (Sig C).

These rectifiers of the fused junction type with all-welded, hermetically sealed construction fea-

NORTH SOLVES REMOTE TV CONTROL PROBLEM

Diamond Power Specialty Corporation, Lancaster, Ohio, had a problem!

In manufacturing remote multiple TV camera systems used in security, fire protection, and similar monitoring applications, they had to provide a remote control system to handle up to 20 control functions for each camera. Each control function required *at least* one wire, resulting in a large, heavy and highly expensive cable. Additionally, the distance from which a camera could be controlled by this system was limited to several hundred yards.

The problem, as presented to North engineers, was: reduce the size of the cable and increase the range!

North's solution went beyond the specifications set – North engineers completely eliminated the control cable, engineering a system in which control pulses are carried over the video co-axial cable; North engineers not only increased the range of their remote control system, they gave it unlimited range.

North's vast experience in designing, engineering, and manufacturing control systems using North telephone-type relays can be similarly applied to your control problems – with solutions as dramatically efficient!

INDUSTRIAL DIVISION

NORTH ELECTRIC COMPANY

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Advertisement

CONTROL PROBLEMS OLD STORY TO NORTH

Complex control problems confronting many engineers working on elaborate systems development represent only routine to the Industrial Division engineering staff of North Electric Company, Galion, Ohio.

During the past decade, with the rapid expansion of automation, high speed computing equipment, remote controls, missile check out, production controls, and a host of allied applications, North engineers have been successfully developing systems and sub systems that have resulted in saving countless man hours and surmounting seemingly insoluble obstacles of time and distance.

New switching equipment has been developed, new components engineered and older components refined, and the accumulated know how of 75 years of specialized experience has been applied to the multitude of control problems that have been brought to North for solution.

North engineers are working constantly in control areas. Their experience in and familiarity with control applications have developed within the company the ability to reduce the most difficult problems to basic elements that have been encountered many times before and to apply their cumulative experience toward a ready solution.

Control questions can best be answered by an engineering group working exclusively in these areas. Specialized problems need the attention of specialists. This is an age of specialization—North Electric Company fits the specialist designation in its sphere and its sphere is (and has been for 75 years) controls. North can, and will, bring your control problems "under control".

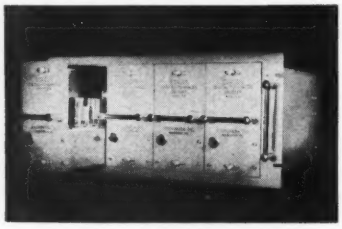
tures, have been developed for application to all types of military equipment. Long term reliability may be expected under extreme environmental conditions of moisture and humidity, shock, vibration, centrifugal forces and temperature cycling.

Recommended storage temperature range from these diodes is from −65 C to +200 C. Under operating conditions, the temperature of the hexagonal base should not exceed +150 C. **Circle 45 on Reader Service Card.**

Decoders

digital-to-analog conversion

ANDROMEDA, INC., 3742 Howard Ave., Kensington, Md. Digital-to-analog conversion of up to 200,000 parallel 10-bit binary codes per sec may be obtained with Edacon decoders. Code accuracy is ±0.05 percent. A four unit rack mounted enclosure is provided for plug-in assembly of up to four decoders. Built-in integral power supplies are featured. Drift is less than ±0.001 percent of full range. The analog



output range is ±50 v at 25 ma. The amplifiers are chopper stabilized. Model 10BR decoder is also equipped with a reference voltage source of ±0.005 percent stability, and capability for supplying reference current to three other model 10B decoders. Dimensions of the rack mounted enclosure for holding up to 4 decoders are 19 in. wide by 8¾ in. high by 17 in. deep. Dimensions of each decoder are 4 in. wide by 7½ in. high by 13 in. deep.

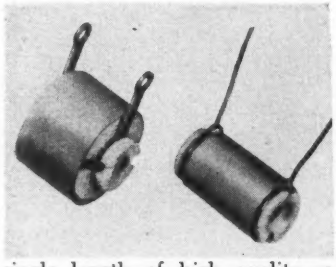
Power requirements are 117 v ±10 percent, 60 cycles ±2 cps; model 10B, 120 w; model 10BR, 160 w; enclosure, 100 w. **Circle 46 on Reader Service Card.**

Ceramic Resistors

lug and radial lead types

GENERAL RESISTANCE, INC., 577 E. 156th St., New York 55, N. Y., has available a full line of commercial, inexpensive ceramic wirewound resistors. Ideal for use where accuracy is required but price is a factor, they are recommended where environmental and mechanical conditions do not have an adverse effect on components.

Life-tested Gen Res wirewound resistors, and the standard hermetically sealed line, are reverse pi-wound to minimize inductance. They are precision made from a



single length of high quality resistance wire, vacuum impregnated in a tough resin, and temperature-aged for ruggedness and accuracy.

These ceramic resistors are available to order in a resistance range of from 0.1 ohm to 10 megohms, and in standard tolerances of 1 percent, 0.5 percent, 0.1 percent, 0.05 percent and 0.02 percent or better. Having a temperature coefficient of ± 20 ppm, they are made to operate in temperatures of from − 65 to + 105 C. Gen Res Hi-Temp ceramic resistors are also available rated for up to 145 C.

Resistors are made to meet all applicable MIL specifications, and can be matched to within 0.002 percent or better. Temperature coefficients can be matched to within 1 part per million. **Circle 47 on Reader Service Card.**

Ultrasonic Cleaner

for production use

ALCAR INSTRUMENTS, INC., 17 Industrial Ave., Little Ferry, N. J., has developed a new 2-kw ultrasonic cleaner for small part cleaning, blind hole washing, removal of radioactive contamination, printed circuit cleaning and other difficult cleaning operations.

The electronic generator delivers 2 kw of power to magnetostrictive transducers welded into the bottom of the stainless steel tank. Dimensions of the tank are 9 in. by 14 in. by 13 in. deep. It holds 5 gallons of liquid. Water cooling of the nickel transducers allows the use of cleaning solutions up to 450 F. Also provided is a 0-15 minute timer which shuts off the generator at a predetermined time. A

switch is provided for by-passing the timer to permit continuous operation.

The 2-kw generator and 9 in. by 14 in. by 13 in. ultrasonic cleaning tank are available either rack mounted or in matching bench-type cabinets. **Circle 48 on Reader Service Card.**

Thermal Relay
supersensitive device

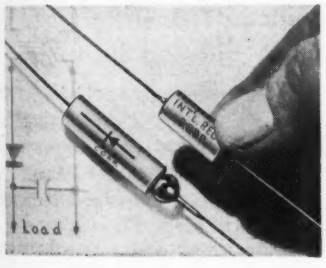
HAMLIN, INC., 1316 Sherman Ave., Evanston, Ill. The TR-103 supersensitive thermal relay is designed and manufactured for many operations with various power requirements ranging from 0.050 w to 0.004 w of d-c, a-c or r-f. Actuating voltage is 0.4 to 0.5 v. Component parts will withstand 1.5 v without failure.

Operational differential voltage is 0.02 v (contact current 0.1 ampere). Contact rating is 1 ampere at 115 v a-c resistive load. With proper arc suppression (0.01 μf) this relay will accommodate a 100 w tungsten lamp load.

The TR-103 is hermetically sealed in a glass vial to eliminate contamination or oxidation of parts and to provide for visual inspection of contacts. Ease of operation by transistor, magnetic amplifier or directly from a solar cell is assured.

Several of many tested applications of the device include its use as a small voltage change (4 percent) detector, an under-or-over current or voltage indicator, a variable time delay and a fail safe monitor for r-f. **Circle 49 on Reader Service Card.**

Power Diodes
high-voltage silicon type



INTERNATIONAL RECTIFIER CORP., 1521 E. Grand Ave., El Segundo, Calif. A new series of h-v silicon cartridge type rectifiers for application to radar power supplies, h-v bias supplies and airborne or guided missile instrumentation are now in production.

The new series, rated at 100 ma rectified d-c output current, is comprised of the IN1410, IN1411, IN1412 and the IN1413, with piv ratings of 1,500, 1,800, 2,000 and 2,400 v respectively. Hermetically sealed, cartridge type construction offers space and weight savings, as well as improved mechanical stability over the v-t rectifiers they replace. Operating temperature range for these diodes is −55 C to 150 C ambient, with optimum reliability at elevated and sub-zero temperatures. **Circle 50 on Reader Service Card.**

Frequency Meter
and error detector

AEROJET-GENERAL CORP., Azusa, Calif., has developed a combined expanded-scale frequency meter and frequency error detector of rugged and low-cost construction.

Any band of frequencies within the meter scale, which is ±5 to ±50 cps with a center frequency of 400 cps may be selected by means of two simple external adjustments. Deviation of the measured frequency from this band is indicated by lamps and closure of relay contacts within an accuracy of 0.1 percent. The error detector circuit is not sensitive to shock and vibration.

The unit also is available with a vibrating reed meter making it a portable and sturdy instrument for field use.

Some applications for which it is being used are rpm measurements using a-c tachometer, 400

Malco IS YOUR BEST SOURCE
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HERE'S WHY:

- **Specialized high production techniques afford lowest possible unit cost.**
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- **Malco specializes in a complete line of small stampings for Radio-TV, electrical/electronic and automotive industries.**
- **Our line includes terminals and printed circuit hardware in loose or in chain form for automatic insertion.**

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Request handy reference catalog containing specifications on standard and custom-made lugs, terminals, corona rings, pins, contacts and similar stampings.

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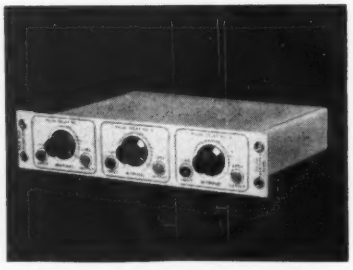
CIRCLE 26 READERS SERVICE CARD

cycle power frequency measurements, monitoring of audio frequencies, and airborne and ground measurements of fluid flow rates employing turbine generators. **Circle 51 on Reader Service Card.**

Capacitors dipped mica casing

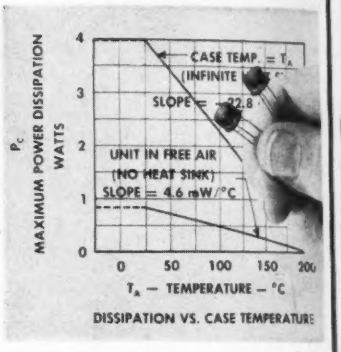
AEROVOX CORP., New Bedford, Mass. Meeting all electrical and environmental test requirements of MIL-C-5A and RETMA RS-153, type ADM dipped-mica capacitors are designed for all printed-wiring and general purpose applications. They feature extremely small size, extended operating temperature range of −55 C to 125 C, narrow temperature coefficient and excellent long-life characteristics. **Circle 52 on Reader Service Card.**



Pulse Delay a transistorized unit

NAVIGATION COMPUTER CORP., 1621 Snyder Ave., Philadelphia 45, Pa., has added a pulse delay unit to the Navcor 100 series of transistorized pulse programming equipment. This new circuit is available as a three-in-one unit, as pictured. Each section provides pulse standardization, pulse delay adjustable from 2.5 to 50 μsec, and square wave output adjustable from 2.5 to 50 μsec. All of these functions may be utilized simultaneously.

The pulse delay unit is designed to be compatible with all other units in the Navcor 100 series, including binary counters, shift registers and gating units. It may also be used to drive other transistor or tube circuits at frequencies up to 200 kc. **Circle 53 on Reader Service Card.**



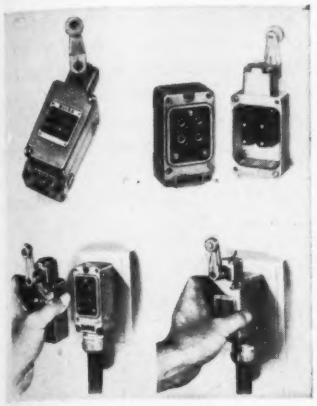
Silicon Transistor with diffused base

TEXAS INSTRUMENTS INC., P. O. Box 312, Dallas, Texas, announces two new diffused-base silicon medium-power transistors. They have 4 w at 25 C case temperatures and 1 w at 150 C case temperature dissipation ratings. These high dissipation/high temperature ratings are a built-in safety factor for designers of low power circuitry.

Both *npn* transistors feature a typical saturation resistance of only 20 ohms at 25 C plus an operating range of −65 C to +200 C. To insure the guaranteed specifications of these devices, they are temperature stabilized at 215 C.

The 2N497 is a 60-v transistor, ideal for use with the 28-v power supplies employed in military aircraft. The 2N498 is a 100-v device for use in higher voltage applications such as servo amplifiers and regulated power supplies for missile applications. Both feature an 800-mw free air temperature rating, an

8-v minimum emitter-to-base rating and a typical static forward current transfer ratio of 20. **Circle 54 on Reader Service Card.**



Limit Switch plug-in type

MICRO SWITCH, a division of Minneapolis-Honeywell Regulator Co., Freeport, Ill., has introduced a new type of precision limit switch that can be replaced on the job in a few seconds with no required adjustments. The unit consists of two parts: a terminal block enclosure, containing wiring connections, and a switch enclosure, including all moving mechanical and electrical parts.

The switch enclosure is fitted with four current-carrying spring plugs, integrally molded to the basic switching element, and the terminal block with four corresponding receptacles. When plugged together they form a complete switching unit. Actuating arms may be pre-set to eliminate on-the-job adjustment.

To make a complete replacement of the switching unit, it is necessary to simply loosen two screws, pull off the switch, plug on the replacement unit and tighten the screws. **Circle 55 on Reader Service Card.**

Synchro transmitter-receiver

JOHN OSTER MFG. CO., Avionic Div., 1 Main St., Racine, Wisc., has developed a more adaptable

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SILICONE RUBBER Tubing and Sleeving

GREATLY ENLARGED

end of Varglas Silicone Rubber Tubing shows design that permits knotting, bending and twisting to meet extremes of temperature while retaining its dielectric strength.

1 WON'T CRACK, PEEL OR CRAZE

2 GREATER FLEXIBILITY

3 HIGH DIELECTRIC RETENTION

4 LONG LIFE CUTS REPLACEMENT COSTS

5 VIVID COLORS FOR READY IDENTIFICATION

THERMAL PROPERTIES:
Heat aging: 1000 hrs. at 250° C without appreciable change in physical or dielectric properties.

FLAMMABILITY:
Self-extinguishing, when tested in accordance with ASTM and NEMA procedures. (NEMA Acceptance Test).

ABRASION RESISTANCE:
Durable and extra tough. Withstands unusual rough handling at all times.

CHEMICAL INERTNESS:
Has good resistance to all oils, alcohols, dilute acids and alkalis. Fine water resistant qualities.

FLEXIBILITY:
Unaffected throughout life of Tubing. Stays flexible from minus 90° F. to plus 600° F.

FUNGUS RESISTANCE:
Inert. No fungus growth was visible at 40 x magnification after 28 days incubation under "ideal" surroundings.

Twist, bend, wrap or knot it and this tubing remains pliable and efficient, even under the most severe operating conditions. Send for free samples today.

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VARFLEX SALES CO., INC.
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Please send me sample with Bulletin and Prices.

Name_____

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Get the Facts About These Cost Saving Terminals and Molded Components

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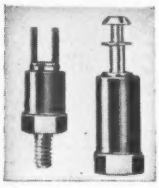

Low cost and high electrical specs. have made these the most popular in the industry. Choice of over 100 varieties—fork, single and double turret, post . . . standard, miniature, sub-miniature . . . molded or metal base . . . wide variety of body materials and plating combinations.

Request Catalog SFT-1

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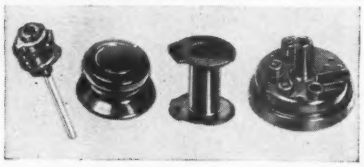

Tremendous savings can now be achieved on large volume custom-molded parts requiring metal inserts. This is made possible through automatic insert handling by our exclusive Blow-Loading Method.

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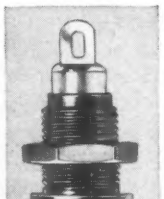

Very economical, yet designed electrically and mechanically for long, reliable service. Supplied in a wide range of code colors.

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A military and industrial favorite by reason of price and practicability. Supplied in attractive black, satin-finished phenolic.

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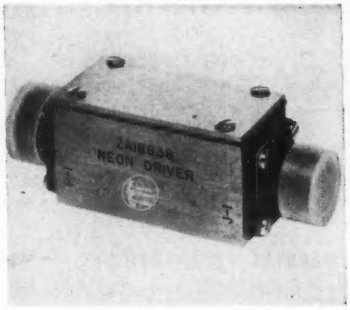
size 10 115/11.8 v 400 cycle transmitter synchro-receiver synchro. Rated input voltage of synchro eliminates step-down transformer, thereby reducing both system size and weight.

Type 10-4081-01 synchro transmitter has an angular accuracy of ±15 minutes. Type 10-4085-07 receiver synchro has 45 minutes accuracy error and 1 deg friction error. Transmitter-receiver system has torque gradient of 2,900 mg MM/degree. Rotor impedance is 810 ± J 2660; stator impedance, 11.5 ± J 29; rotor impedance with stator short circuited, 1000 ± J 450; phase shift, 7 deg rotor to stator; rotor resistance, 360 ohms; and stator resistance line to line 9.5 ohms. **Circle 56 on Reader Service Card.**



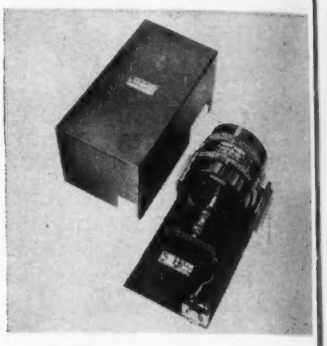
Neon Driver completely transistorized

Electronic Engineering Co. of California, 1601 East Chestnut Ave., Santa Ana, Calif., has developed a small, rugged camera timing lamp driver which may be connected directly into the timing signal cable.

The neon driver furnishes power to flash neon camera marker lamps to display time code signals in optical instrumentation devices, such as high speed cameras or cinetheodolites, and may be mounted directly at the camera in the signal line from the time code source. Measuring 1⅜ in. by 1¼ in. by 3⅝ in., the unit is completely transistorized.

Use of the neon driver enables the distribution amplifier to be located next to the time code generator with only the neon drivers themselves located with the cameras or other instrumentation devices at a field site. The cable connecting the driver and the distribution amplifier is two-conductor shielded cable which can be up to ½ mile in length.

The neon driver employs a single, medium power, high temperature, silicon transistor as a constant current driver to furnish lamp currents up to 15 ma. A d-c "keep-alive" current flows in the neon lamp to provide easier starting in darkness. **Circle 57 on Reader Service Card.**



Sampling Switch with multipin connectors

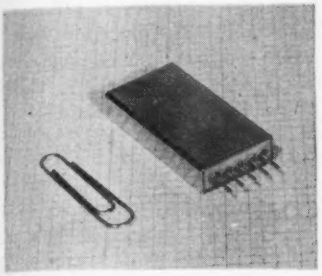
General Devices, Inc., P. O. Box 253, Princeton, N. J. A precision switch having miniature multipin connectors attached to barrier strips on either side of the switch, is designed for military and commercial applications. Featuring two poles, 120 contacts, and 60 nonshorting channels per pole, the switch is available with or without a drive motor. The motor supplied with the switch operates on 115 v, 60 cps a-c.

The company's exclusive constant force perma brushes and lifetime semimolded contact plates insure long service-free life. The rotor and all brushes may be replaced as a unit. The cover plate is easily removed for inspection of the brushes and the contact plates.

Approximate dimensions are 5¼ in. in height by 5⅜ in. in width by 10 in. in length. Typical applications include stabilization of groups of high gain d-c amplifiers, multichannel data systems and error in-

dicating systems.

Current models include single or multiple pole, stacked, concentric, opposed, raised contact, segmented or printed circuit design. **Circle 58 on Reader Service Card.**



Preamplifier transistorized Unit

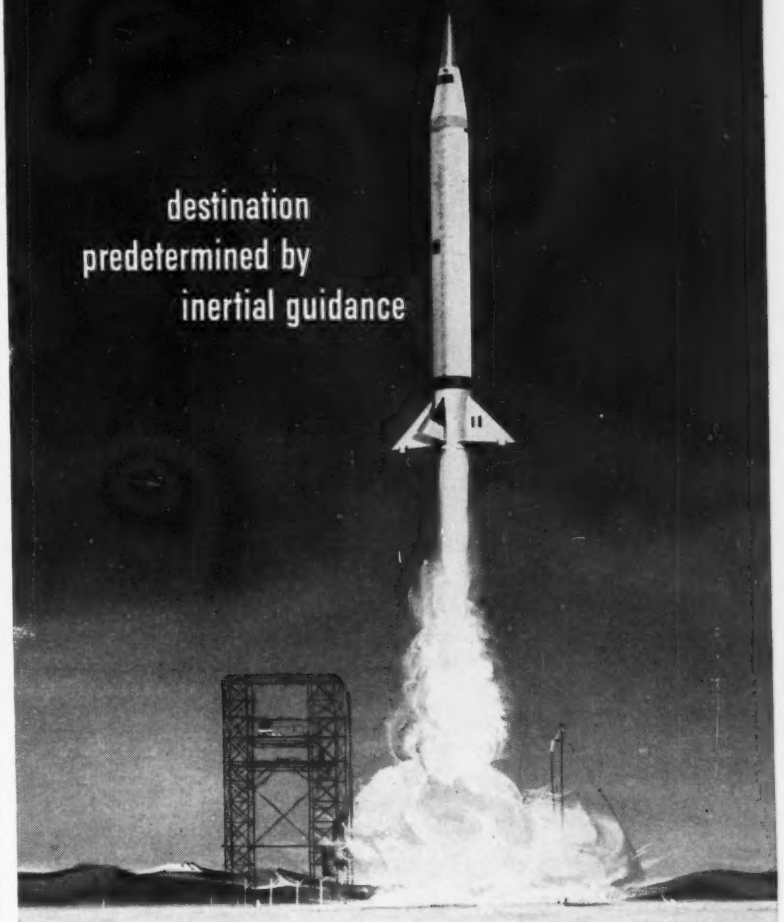
DYNALYSIS DEVELOPMENT LABORATORIES, INC., 11941 Wilshire Blvd., Los Angeles 25, Calif. Model 5-1501 preamplifier is a high sensitivity transistorized unit for amplifying low level a-c signals from 40 to 20 kc. It has a high input and low output impedance and may be used to drive model 7-1002 preamplifier flip-flop or model 7-1004 Schmitt-Trigger from low level signals or used as an audio signal preamplifier. **Circle 59 on Reader Service Card.**

Stereo Cartridge consists of two coils

FAIRCHILD RECORDING EQUIPMENT Co., 10-40 45th Ave., Long Island City 1, N. Y., has available stereo cartridges developed to play back the 45/45 Westrex stereo groove. The moving coil cartridge consists of two coils—one placed inside the other, and mounted at right angles to each other at 45 deg to the vertical axis. Vertical components produce an equal and in-phase output from both coils while lateral components produce an equal but out-of-phase voltage from both coils.

Crosstalk between channels is attenuated by approximately 20 db at 1 kc. The stereo cartridge uses a 0.5 mil diamond stylus and has approximately 3 mv output per channel. **Circle 60 on Reader Service Card.**

Kearfott's creative engineering and production experience assures the precision and reliability of their inertial guidance systems for the successful performance of all airborne equipment.



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Pennsylvania recently took major steps to create a new "tax climate" favorable to new and established industries. The following basic tax changes were enacted in 1957:

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Machinery and equipment taxes were eliminated, state-wide;

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The Pennsylvania Department of Commerce, through its staff of engineers and economists, will "custom-tailor" complete plans for a new plant site to your specific requirements. Special reports and tabulations will be presented covering labor, markets, transportation, communities, raw materials, minerals, water, power, fuel, engineering services, research laboratory facilities, etc.

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Main Capitol Building, 1097 State St., Harrisburg, Pennsylvania, Tel: CEdar 4-2912

Literature of

MATERIALS

Hermetic Sealing. Mitronics Inc., 1290 Central Ave., Hillside, N. J., has new literature available for high altitude, high voltage Solderseal terminals, as well as for high and low temperature metallized ceramic and alumina for hermetic seal applications. **Circle 61 on Reader Service Card.**

COMPONENTS

Coax Components. Microlab, 71 Okner Parkway, Livingston, N. J., has published a 28-page catalog describing a complete line of coaxial components. Theory of operation and application data are included for all products. **Circle 62 on Reader Service Card.**

Filters and Capacitors. Airborne Accessories Corp., 1414 Chestnut Ave., Hillside, N. J. Performance features and design innovations of a new line of miniaturized r-f filters and capacitors are described in bulletin No. 57 B. **Circle 63 on Reader Service Card.**

Magnetic Shielding Capsules. Magnetic Shield Division, Perfection Mica Co., 1322 No. Elston Ave., Chicago 22, Ill. Data sheet 137 illustrates and describes the new tiny Co-Netic magnetic shielding capsules which virtually eliminate hum and noise caused by low level extraneous electromagnetic and electrostatic fields in subminiature reactors or transformers used in transistorized and printed circuits. **Circle 64 on Reader Service Card.**

Quartz Crystal Filters. Burnell & Co., Inc., 10 Pelham Parkway, Pelham Manor, N. Y., has published a two-color, four-page brochure outlining a comprehensive product line of stock and special miniaturized quartz crystal filters. It includes technical data, and typical and representative curves of filters that have been developed and are manufactured by the com-

the Week

pany. **Circle 65 on Reader Service Card.**

EQUIPMENT

Cathode-Ray Instruments. Tektronix, Inc., P. O. Box 831, Portland 7, Oregon. An 8-page bulletin illustrates and describes three cathode-ray instruments. Included are a transistor-curve tracer, a d-c-to-10 mc X-Y oscilloscope, and a d-c-to-10-mc portable oscilloscope. **Circle 66 on Reader Service Card.**

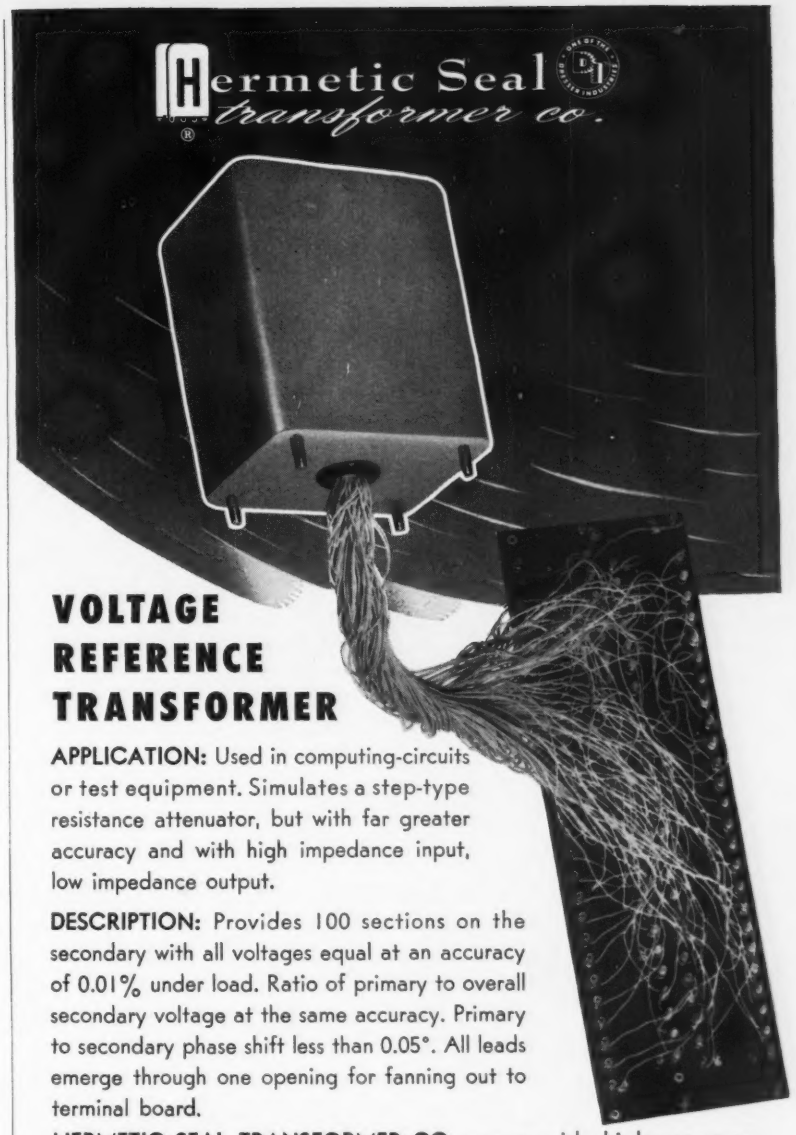
Remote Radiation Monitor. Eberline Instrument Division of Reynolds Electrical and Engineering Co., Inc., 805 Early St., Santa Fe, N. M. Specifications and design features for the model RRM-1 remote radiation monitor are given in a recent catalog sheet. **Circle 67 on Reader Service Card.**

Synchros. Muirhead Instruments Inc., 677 Fifth Ave., New York 22, N.Y., has available a sheet presenting the salient characteristics of the company's synchros, servomotors, resolvers, motor tachometers and tachometer generators. **Circle 68 on Reader Service Card.**

Standard Frequency Generator. An-Yu Electronics Lab., Inc., 249-259 Terhune Ave., Passaic, N.J. A single-page bulletin covers the type 209 standard frequency signal generator which features accuracy within ±0.005 percent. Specifications and price are given. **Circle 69 on Reader Service Card.**

FACILITIES

Glass-To-Metal Seals. Networks Electronic Corp., 14806 Oxnard St., Van Nuys, Calif. A brochure is available on a new line of glass-to-metal seals. It illustrates and describes complete facilities for production, quality control, inspection and environmental and qualification testing for high reliability. **Circle 70 on Reader Service Card.**



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APPLICATION: Used in computing-circuits or test equipment. Simulates a step-type resistance attenuator, but with far greater accuracy and with high impedance input, low impedance output.

DESCRIPTION: Provides 100 sections on the secondary with all voltages equal at an accuracy of 0.01% under load. Ratio of primary to overall secondary voltage at the same accuracy. Primary to secondary phase shift less than 0.05°. All leads emerge through one opening for fanning out to terminal board.

HERMETIC SEAL TRANSFORMER CO. can provide high accuracy voltage reference transformers or autoformers to specifications with accuracies even better than shown above. The production of this type of transformer requires the special design and the special testing techniques which are customary at Hermetic Seal Transformer Co. Your inquiries are invited. No obligation.

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DIVISION OF SOUTHWESTERN INDUSTRIAL ELECTRONICS CO.

Air Pay-Tv Trials "Banned"

Congress turns thumbs down on trial broadcasts of subscription-tv as free-or-fee controversy mounts

CONGRESS' RECENT "request" asking FCC not to permit trial pay-tv broadcasts now is greeted by many with sighs of relief.

Major networks all say they oppose pay-tv, although all admit they'll go pay if they must. Typical network sentiment is summed up by Leonard Goldenson, president of ABC, who says, "Permitting trials of pay-tv is like starting an epidemic to test a new vaccine . . . however, if pay-tv became a successful reality, we would be obliged to enter the field."

Trial has brought tribulation to the country's only currently operating pay system. In Bartlesville, Okla., Video Independent Theatres which began showing movies by direct wire last September is experiencing stormy weather. Subscriptions have fallen from a high of over 500 to about 300. The system needs 2,000 subscribers to break even. Henry Griffing, system's promoter, says he can't pin down reasons for the decline, but has complete confidence in ultimate success.

Despite Bartlesville reversals similar operations in Los Angeles are still being considered. Promoters of plans to wire LA must, however, await outcome of a June public referendum. Voters will decide whether existing 21-year franchises should be revoked. Plans are still being made for tryouts in other cities.

The House Commerce Committee, headed by Rep. Harris, (D., Ark.) applies the bulk of pressure against broadcast pay systems. There are, however, a total of 19 bills on Congressional agendas, all of which are against pay-tv in varying degrees.

Some names appearing on Hill dockets are: Senators Magnusen, (D., Wash.) and Thurmond (D., S. C.) who favor complete outlawing of pay systems; Representatives Beamer (R., Ind.), Hemphill, (D., S.C.), Morrison (D., La.), Dingell (D., Mich.) and Radwan (R., N.Y.).

Mail on the free-or-fee issue is flooding Congress. Rep. Dingell got some 10,000 letters through WJBK-TV, Detroit. Only 51 writers favored pay-tv. Other pulse-takings around the country show a similar attitude.

Senator Long (D., La.) is asking for investigation of Zenith charges that mail barrage is a result of network pressure.

"We have no fears that present Washington activity will affect our wire operations." says Arthur Levey, Skiatron Electronics' president. He expresses complete confidence in pay-tv's future. International Telemeter echoes this, says it will be prepared to operate either on airwaves or wires. Demonstrations of the firm's wire system were held last month in Chicago.

FCC ACTIONS

• **Advises** that report on network study is now on sale through GPO at $2.00 a copy.

• **Orders** that effective today new or changed equipment requiring type acceptance must be accompanied by a photograph.

• **Invites** comment by April 30 to petition by Maritime Mobile Amateur Radio Club to make additional "ham" frequency bands available to licensed amateurs living outside the U.S. and possessions.

• **Amends** tv table assignments to substitute channel 80 for 70 in Bradford, Pa., to make channel 70 available for translator service in North Warren, Pa., area.

• **Extends** filing time to July 15 for comments on proposal to require using single sideband in aeronautical mobile and fixed radiotelephone service below 2500 kc.

• **Grants** requests of Evangeline Broadcasting Co. and Arcadian Tv Corp. to accept supplements to their pending pleadings on applications for a new channel 3 station in LaFayette, La.

• **Issues** c-p to New England Telephone and Telegraph for base station and 100 mobile units in Framingham, Mass.

STATION MOVES and PLANS

WIMA-TV, Lima, O., receives c-p to change erp visual to 195 kw, aural 97.7 kw, antenna to 340 ft.

WOOO, DeLand, Fla., files for c-p modification to extend completion date.

KIVY, Crockett, Tex., is given authority to sign off at 6:00 p. m. local time.

WTAO, Cambridge, Mass., asks for c-p to up power from 250 watts to 5 kw, change from 740 to 760 kc, and change type transmitter.

KXLE, Ellensburg, Wash., trans-

fers assignment of license to Washington Broadcasting Co.

WHGR, Houghton Lake, Mich., seeks permission to switch to unlimited hours at 5 kw, install directional antenna for night use.

WAHL, Hastings, Mich., is granted license for a-m station.

WCHJ, Brookhaven, Miss., applies for authority to determine operating power by direct measurement of antenna power.

KNOC, Natchitoches, La., gets license covering change in antenna-transmitter location, studio location, and permission to operate transmitter by remote control.

WLET-FM, Toccoa, Ga., applies for renewal of license.

WETO, Gadsen, Ala., plans installation of new transmitter.

WWHG, Hornell, N. Y., files for license to cover increase in power and installation of new transmitter.

KDLO-TV, Florence, S. D., is granted acquisition of positive control by E. R. Ruben, N. L. Bentson, J. L. Floyd, and L. M. Goldfarb as voting trustees.

KTVU, Oakland, Cal., begins broadcasting on channel 2.

KITO, San Bernardino, Cal., sees assignment of license grant c-p to Radio Associates, Inc.

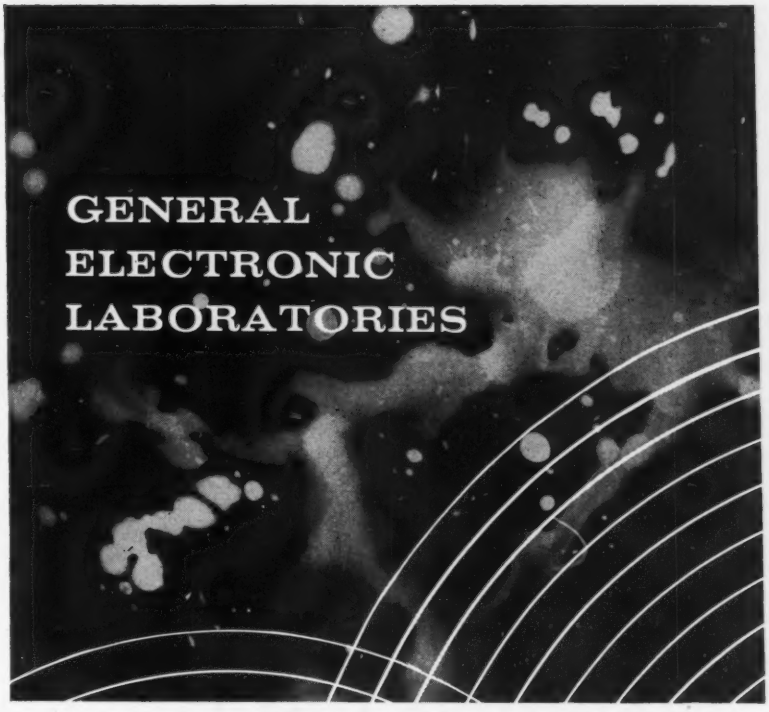
WTAE, McKeesport, Pa., gets c-p change to allow move in transmitter location, and antenna changes.

WFDF, Flint, Mich., is permitted to cancel license for auxiliary transmitter.

WRC-FM, Washington, D. C., plans to remain silent until March 19.

WCDC, Adams, Mass., receives extension of completion date to August 15.

KPID, Payette, Idaho, gets license for a-m station.



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IN ELECTRONIC EQUIPMENT...

from idea through production

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GEL's engineering laboratories in Cambridge, Mass., and Silver Spring, Maryland, are currently engaged in 25 prime research and development contracts from many agencies of the Department of Defense. These contracts include a number of advanced military systems and equipment for ground, ship, aircraft, and missile applications. In addition, the Company has completed a number of development projects for industrial firms.

As a result of its extensive experience, GEL is equipped to carry on any single phase or the complete program from development through production to suit customer's requirements. If you are interested in extending your own research facilities, or in a development or manufacturing program, GEL can be helpful. Your inquiry will receive a prompt reply.

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GENERAL ELECTRONIC LABORATORIES, INC.

18 Ames Street • Cambridge 42, Massachusetts

Air Force launches radio astronomy program; uses sun as transmitter to test atmospheric effects on signals. It's all a part of the new work being done in . . .

Mapping the Heavens

THE AIR FORCE is getting ready to map the "wild blue yonder"—to determine exactly how the natural radio environment over the earth's surface is affected by radiation from the sun, moon, stars and planets.

Radio astronomy will be a basic tool. Goals of the program are:

- Instantaneous communications with satellites, missiles.
- Learning effective use of radio transmitters in space.
- Astronautics, particularly celestial radio navigation by using radio stars plus emission from gaseous clouds.
- Communications between the earth and space vehicles.
- Interspace vehicle communications.

Radio astronomy is already being used to calibrate radar receiving antennas by radio-frequency energy from the sun, to catalog solar and astral radio-frequency emission and to measure lunar reflectivity.

A scientific team at Air Force Cambridge Research Center in Bedford, Massachusetts, is conducting the new program.

In addition to calibrating radar antenna patterns, radio-viewing of the sun is seen as the best means for determining optimum normal h-f transmission frequencies through studying radio storms on the sun and the resulting ionospheric storms. Solar storms are the basic cause of polar blackout in the Arctic. The Propagation Laboratory at AFCRC is now using the sun as a radio transmitter to obtain data that includes the effect of the atmosphere on radio waves.

By radio astronomy techniques also, atmospheric absorption has been rather accurately measured at C, X and K_a bands. In studying atmospheric effects on signals, vitally important in missile and radar problems, AFCRC refraction work—using the sun as the source of energy—shows that the ionosphere increases the bending at vhf but has less effect at higher frequencies.

For new experiments during the next two years, several recently developed stable and sensitive receivers are to be placed on a new 84-ft dish which will be operational this spring at AFCRC's Ipswich, Mass., field site.

These radiometers incorporate new techniques in ferrite switching and traveling-wave amplification. The 218, 400, 1,200, 3,200 and 4,600 mc equipments will be used to study atmospheric effects on celestial signals, background radiation, solar system studies, absorption studies and ionospheric experiments.

Little data is available at frequencies above 900 mc because of receiver insensitivity and small antenna area.

A sweep frequency receiver covering the band 35-70 mc is being developed for northern-latitude studies. Further developments with sweep frequency equipment are expected to yield amplitudes of solar signals for accurate determination of solar burst levels as compared to the quiet sun signals. Aim is to evaluate solar noise levels in the noise environment surrounding radar or communication systems.

Using More C-C Tv

Reports in from Boston, Detroit and Los Angeles point to new gains in fast-growing market

CLOSED-CIRCUIT TV is taking another step forward as a mushrooming market. New reports—just in from Boston, Detroit and Los Angeles—indicate this.

In Boston, closed-circuit tv will "patrol" the widest vehicular tunnel in the U.S., the Dewey Sq underpass of the Hub's Central Artery. Twelve or more industrial tv cameras will be strategically mounted in the 2,400-ft subterranean roadway.

In Detroit and Los Angeles, closed-circuit tv is being tried experimentally as a new "eye on the road."

It's job: watch and control millions of vehicles using expressways and freeways daily. Result so far: promising.

In fact, one industry source predicts such use of closed-circuit tv may be "a $10 million market within two years after the first permanent installation."

Says Detroit's Street and Traffic Dept. Director Alger F. Malo: "We are firmly convinced, after extensive experimentation, that closed-circuit tv can be adapted for use in traffic control."

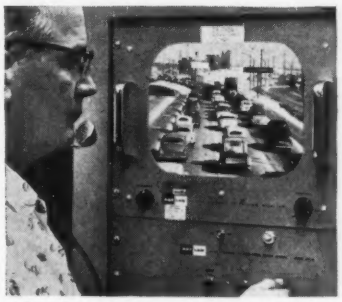
Many industry people share this optimism. R. T. Silberman of Cohu Electronics' Kin Tel Division thinks "traffic monitoring is practical, comparatively inexpensive. And it works equally well in daylight or darkness."

Test facilities were installed in Detroit by Kin Tel, Jerrold Electronics and Motorola.

Silberman estimates the tv patrol cost at $5,000 to $7,000 per mile.

Boston's tunnel installation will cost an estimated $30,000 to $50,000. Bernard D. Twombly, traffic engineer, Massachusetts Dept. of Public Works, says, "We expect to save about that much each year. It would take at least 10 men to patrol the tunnel around the clock."

With tv cameras, the entire traffic control system will be operated by one technician from a ground-level building.



Closed-circuit tv enables one man to keep tabs on thousands of vehicles whizzing along freeways

To make the system simple, emphasis will be functional rather than on circuitry. "Each camera will have an individual circuit, rather than a common r-f carrier," Twombly says. "We want no r-f voltages. We want video voltages.

Plans calls for four receiving screens, two for each traffic direction. Stepping switches will allow the operator to shift from camera to camera.

Ask National Research Lab

DEMANDS continue to mount for some form of a central national research laboratory.

Sen. Henry M. Jackson (D.-Wash.) recently advocated "prompt establishment of a national new project laboratory under civilian direction.

"Our best scientists have no one central place to go to exchange ideas about critical problems and to examine and test possible approaches to them," Jackson said.

Rear Admiral Rawson Bennett, chief of naval research, told the National-Military Industrial Conference in Chicago:

"There should be one collected list of basic research undertakings available somewhere in government."

He suggested the Dept. of Commerce or the National Science Foundation might become such a repository.

Computer Shows Japan Gaining

JAPANESE government laboratory announced last week that it has developed a digital computer the size of a teletypewriter, evidence that Japan's big government subsidized electronics push is paying off.

Storage capacity of the computer is reported to be 6,000 digits, with operation as fast as some Western machines. It may be marketed by April 1959 at a retail price between $55,000 and $83,000.

Why Explorer Beeped Again

LAST WEEK, the larger of the two Explorer radio transmitters began operating again after having stopped on Feb. 12. A reliable source close to the satellite program offered two possible explanations.

He said: "It was assumed the heavily-loaded mercury cell supplying the emitter current had been exhausted. When it is, the emitter bias on the transistor controlling the oscillator drops below a certain minimum voltage and the oscillator stops.

"If the emitter circuit is opened, however, the emitter current goes to zero and the oscillator starts again.

"This phenomena," he said "has been observed in the laboratory but to date no reasonable theory has been advanced to explain it. If the r-f circuit is behaving in this fashion, the resulting oscillator instability should show up on the recordings of the signal."

Another possibility is that an imperfect contact cut off the transmitter initially, then a shock of some sort reestablished the circuit. The shock could have been the result of meteorites penetrating the satellite shell.

NATO Tackles Patents

Solution of 'rights' problems is essential to any NATO agreement on joint electronics production

PARIS—Joint military research and production, proposed at last December's summit talks, will be taken up shortly by NATO defense ministers. They are expected to meet in May instead of this month as originally planned.

Right now, NATO experts are attacking the problems of patent and proprietary rights that would be involved in any joint production plan for electronics equipment.

France, West Germany and Italy agreed in principle last January to produce arms together. But before a full-fledged NATO agreement is possible, the tacky problems of patents and proprietary rights must be solved.

The United States Government owns only shop rights (rights to manufacture equipment) on equipment ordered under contract from U.S. electronics firms. It can give the equipment but not the designs to European governments.

Licensing agreements between U.S. developers and European firms are necessary before the Europeans can manufacture American equipment. If a full exchange of technical know-how and coordinated production are to be achieved in military electronics, there must be a new system of international patent pooling.

NATO's approach to patents is of special concern now to the electronics industry. European allies have a great quantity of American electronic gear approaching obsolescence, some of it dating from World War II. A joint production program may come just in time to replace this old equipment. What equipment will be chosen, who will produce it and for whom, are questions keeping NATO's defense production committee busy these days.

How joint electronics production will be paid for is another big question. European NATO members can probably finance only a small part of such a program, and will look to the U.S. for help. But a U.S. economic recession could complicate the situation even more. That is, if nonmilitary electronics sales drop sharply, U.S. firms will want more defense work. And they won't like the idea of the U.S. supporting European electronics.

Up to now, NATO experts have studied equipment and tried to get member countries to agree on standardization. NATO's Military Agency for Standardization publishes a list of such agreements. This procedure is said to have operated satisfactorily with regard to components, but to have been less successful when it came to complicated assemblies.

DEVELOPMENTS ABROAD

• **Russian submarine** is being converted into an underwater laboratory, a Soviet report says. Echo-sounding gear will locate schools of fish above the ship and provide comparative data on the reflective properties of the surface of the water. Sub will have special forward windows, powerful searchlights, photographic equipment and an underwater tv camera to give armchair observers a view directly ahead of the ship. Devices will sample water and measure its temperature and oxygen content at various depths. Maiden voyage is scheduled for next summer.

• **Sweden's** Atvidaberg Co. announces a new computer, the Facit EDB, which will be the nucleus of a computer center. Facit EDB is called an improved version of the Swedish government's BESK computer. It performs 23,000 additions or 3,600 multiplications of 12-digit numbers per second, and has fast ferrite memory and magnetic drum with capabilities of 2,048 and 8,192 12-digit numbers respectively. Machine uses more than 2,000 tubes and transistors; power consumption is 17 kw.

• **Ukrainian** academy of sciences is assembling the Kiev, a new electronic computer that can be used to control metallurgical and chemical processes. Computer was developed at the Ukrainian mathematics institute and can perform 7,000 operations per second. Reliability is reportedly enhanced by semiconductors, improved circuitry and autonomous operation of various units on different frequencies.

EXPORTS and IMPORTS

South Africa is launching an electronics industry to fulfill a basic requirement of industrial development. Aim is to be self-supporting in electronics manufacture within a decade. Meanwhile, orders for electronics equipment for the next five years are said to be worth several million pounds. The Union Cabinet has approved agreements for telecommunications gear with three British firms and one German firm. Plans call for eventual home manufacture of telephone, telegraph, radar, tv, radio and navigation equipment.

European demand for U.S.-made transistors in 1958 will be at least three times greater than last year, in the opinion of Industro Tran-

sistor Corporation's European manager, Leon Halfin. Demand, he said, will be stimulated both by greater use of transistors by European manufacturers and by the superiority of American transistors.

In Australia last month, The Sheffield Corporation of Dayton, O., opened a new machine tool, gage and instrument plant at Clayton, Victoria. Louis Polk, president of Sheffield and vice president of parent Bendix Aviation, told Australian government and industrial figures at the dedication that by 1968, 500 million pounds ($1.12 billion) at a minimum will flow from the U.S. to Australia for further industrial development.

In London Standard Telephones and Cables announced that it won a $700,000 contract for the manufacture and installation of remote control equipment for the Kariba hydroelectric scheme on the Zambezi river in the Central African Federation. Equipment will permit finger-tip control of the system linking Kariba with other stations. Contract was awarded by Federal Power Board of Rhodesia and Nyasaland.

Japan last year paid $42,778,000 in royalties for foreign technical and patent rights, according to Pegasus International Corp., foreign trade consultants. Royalties were paid on 1,412 contracts, most of them with small and medium-sized U.S. firms. Many of these are in electronics. Pegasus says increased licensing activity with Japan is due to Japanese policy of freely remitting royalties in dollars.

French firm Societe d'Etudes et de Constructions Electroniques has delivered an electronically controlled power plant to Belgium. Installation is designed to meet fluctuating demand, without overcharging international lines connecting Belgium, French, German and Dutch networks. It includes 30 regulating systems, distributed throughout the principal Belgian power plants, supplying about 600 mw to a master regulator in Brussels.

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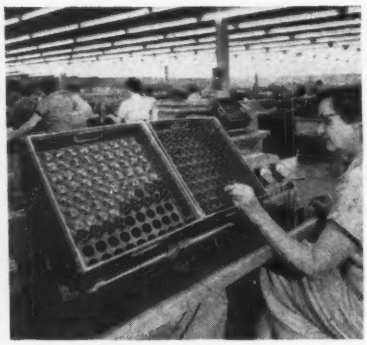

Plant Problems Eased

MARKED improvement in efficiency of materials handling and storage operations through substitution of vulcanized fibre cartons for corrugated cardboard containers has recently been reported by two electronic firms.

One of the two, Heath & Co., manufactures radio and electronic kits at plants in Benton Harbor, Mich. The other, C. P. Clare & Co. of Chicago, produces relays and switches used in electronic and electrical machinery and communications systems.

Heath and Clare, like many other electronic firms, have the problem of handling and protecting thousands of small electronic parts in transit between plant use points and storage.

By switching to fibre containers the two firms report they speeded up the parts handling job. Storage space has been better utilized, damage and loss of parts has been almost eliminated, the companies say.

For instance, at Heath loss and damage in trucking parts to a nearby plant for plating has officials say, been reduced 100 percent. When corrugated cartons were used, they add, cardboard boxes burst under the strain of hauling.

Heath also reports that it doubled warehouse efficiency and is now better able to get parts from storage when needed. Stable stacking ability of fibre containers was chiefly responsible, firm says.

For example, fibre cartons are loaded on pallets and stacked (pictured, left) by fork truck in four-square piles, up to 18 feet high and weighing more than 1,000 lbs. Individual boxes can be quickly removed by lifting the top part of the palletized stack a few inches by fork truck.

When corrugated cartons were used, the company reports, it was necessary to break down the stack to get at a lower box. In addition now, damage to parts due to buckling of stacks has been completely eliminated since the shift to fibre, the firm says.

Clare says its experience, though different in detail was generally similar and resulted in like improvements.

In addition, Clare was able to use fibre cartons as assembly line work containers by adding built-in shelves (pictured, right). The shelves were built to hold 100 contact relays in correct position at all times.

Clare also found that use of fibre containers simplified inventory control since the standard-size containers provided an automatic counting system for production, inspection and shipping.

Basic advantage of vulcanized fibre, which enabled it to outperform corrugated cardboard in these two instances, is lightness of weight combined with structural strength, company spokesmen say.

Vulcanized fibre, a resilient cellulose plastic, is one of the strongest, lightweight materials known to industry today. It is capable of absorbing considerable impact without damage. It is chemically inert and smooth-surfaced.

Doppler Radar Dons Civvies

DOPPLER RADAR for civil air navigation now comes of age, as is proved by the latest of several dozen successful flight tests conducted by Pan American World Airways.

After satisfactory performance in a DC-7, the new system, RADAN, is now slated for installation in all 44 jet airliners being built for Pan American by Douglas and Boeing.

RADAN obtains the basic information of ground speed and drift angle by four high-frequency radio probes that scan the surface of the plane's flight path. Combining this information with compass heading allows long-range navigation without ground-based or celestial aids for the first time in the history of air navigation. (See ELECTRONICS, Oct. 10, 1957.) The RADAN system weighs 89 pounds.

ESC Appoints Production Mgr

THE ELECTRONIC components division of ESC Corp., Palisades Park, N. J., names Joseph S. Dec (picture) production manager. He was formerly associated with the Allen B. DuMont Laboratories as foreman in their transformer department.

In his new capacity at ESC, Dec will be responsible for the manufacturing and testing of the company's extensive line of custom-

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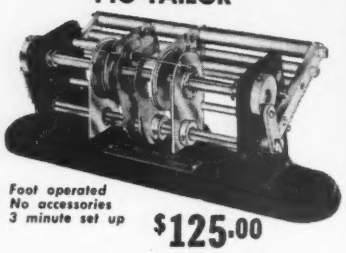

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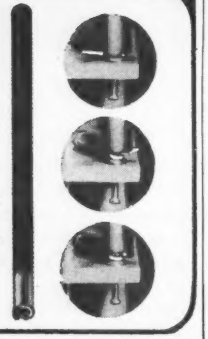

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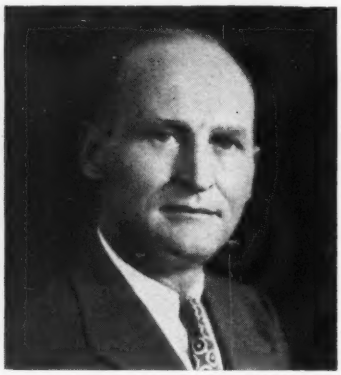

Cinch Elects Executive V-P

AT A RECENT meeting of the board of directors, E. J. Pool (picture) was elected executive vice-president of the Cinch Mfg. Corp., Chicago, Ill., manufacturers of electronic components. He continues as general manager, a position he has held for the past four years.

Foto-Video Expands

PART of a general expansion program by Foto-Video Laboratories, Inc., is the recent acquisition of a new 10,000 sq ft plant (picture) in Cedar Grove, N. J. Electronic manufacturing facilities have already been transferred to the new plant.

Established in 1954, Foto-Video Laboratories manufactures a line of testing and control instruments, amplifiers, monitors and sync generators for tv networks and studios and for industrial tv applications. The company states that its sales volume has more than doubled in each year of its production.

The company also announces that a new line of transistorized power supplies is now being manufactured and sold. These power supplies are being used in many general industrial applications.

Set Up New Consultant Firm

FRED W. MORRIS, JR., announces establishment of Electronic Engineering and Management Consultant offices in Palo Alto, Calif. He and his associates have been active in the engineering and management consulting field since World War II, having served academic, industrial and governmental clients including: MIT; University of Southern California; Remler Co. Ltd., San Francisco, Calif; Bomac Laboratories Inc., Beverly, Mass.; Sylvania Electric Products Inc., Mountain View, Calif. and Waltham, Mass.; Instruments For Industry Inc., Mineola, N. Y.; Department of the Army Signal Corps; R&D Board of the Department of Defense; and the Office of the Assistant Secretary of Defense (Research and Engineering).

The newly established Palo Alto office will serve principally the particular needs of an—as yet unidentified—Eastern organization in planning for the establishment of a West Coast affiliate.

Morris' technical specialties include phases of advanced military electronic countermeasures systems, counter-countermeasures, reconnaissance and radar systems, and electronic weapon system performance and evaluation.

Two RCA Men To Get Awards

THE FIRST David Sarnoff Outstanding Achievement awards in science and engineering will be presented to Albert Rose of the Technical staff of RCA Laboratories, and David K. Barton of the engineering staff of RCA Defense Electronic Products.

The two awards, to be made annually to the outstanding scientist and the outstanding engineer of the

Radio Corp. of America, were established in September 1956, to commemorate the fiftieth anniversary in radio of General Sarnoff, chairman of the board of RCA. Each of the awards consists of a gold medal and a citation.

Rose is being cited "for basic contributions to the understanding and utilization of photoelectric phenomena." Barton's citation specifies "for important contributions to precise tracking radars."

The medals will be presented to both men by General Sarnoff early in March.

Shaw Named Chief Engineer

APPOINTMENT of Richard A. Shaw (picture) as chief engineer of Neff Instrument Corp., Pasadena, Calif., is announced.

Prior to joining Neff, he was with the Alectra Division of Consolidated Electrodynamics. He was also a development engineer for Collins Radio Co. for five years. Shaw has participated in the development of transistorized test equipment, communications receivers, and transmitters.

Aerophysics Appoints Two

IN Santa Barbara, Calif., Aerophysics Development Corp. appoints Ernst Steinhoff associate

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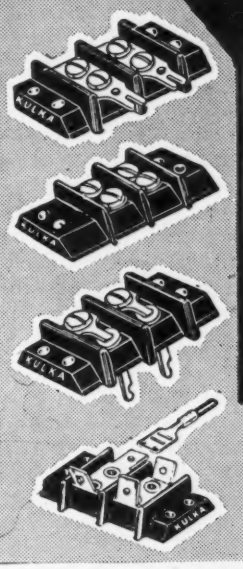

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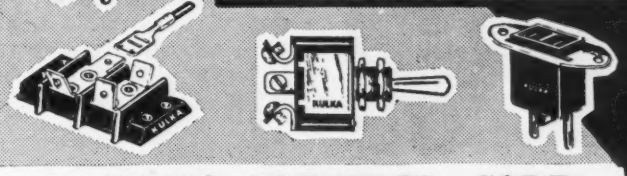

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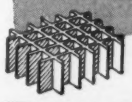

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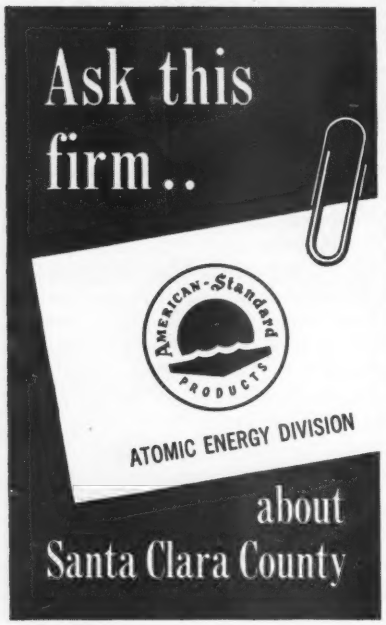
Studying Industrial Sites?



"If we were asked to state a single reason why we selected Santa Clara County, it would be very difficult", said Mr. Frank A. Parker, Director, Atomic Energy Division of American-Standard. "The fact that this was the center of nuclear learning played an important part. Naturally our Atomic Energy Division could benefit greatly by this proximity.

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technical director. He has been department manager of Air Force Missile Projects at Aerophysics, a position he will retain.

Helmut Kuerschner is named chief of the computer operations projects office in the Air Force Missiles Department. He will also serve as acting chief of the electromechanical systems section in the Electronics Department.

Prior to joining Aerophysics, Kuerschner was supervisory aeronautical research engineer and chief of the flight simulation branch, Air Force Missile Development Center, Holloman Air Force Base, New Mexico.

Copeland Upped at Bendix Corp.

With the company since 1944, E. Wayne Copeland (picture) has been appointed telemetering sales manager at Pacific Division, Bendix Aviation Corp., North Hollywood, Calif.

He was formerly assistant sales manager, telemetering. Previously he was a sales engineer dealing with telemetering and instrumentation as applied to missiles, drones and aircraft, and earlier was projects supervisor in the missile development section, engineering.

In his new position, Copeland will handle sales of airborne telemetry transmitting components and systems manufactured by Bendix-Pacific, as well as the Epsco, Inc., line of receiving station equipment for which the company recently acquired exclusive worldwide sales rights.

Bendix-Pacific supplies components and systems for most of the major U. S. missile programs, and for aircraft flight testing.

RCA Adds to Executive Staff

Edwin A. Speakman, former vice-president and general manager of Fairchild Engine and Airplane Corporation's guided missile division, is named to the newly created post of manager of planning for defense electronic products, RCA, Camden, N. J.

The new staff member, who served for several years as vice chairman, Research and Development Board, Department of Defense, will be responsible for analyzing military requirements, planning new programs and products, and coordinating short- and long-range planning for RCA's defense electronic products.

ASCOP Changes Division Name

The Applied Science Corp. of Princeton has changed the name of its switch division to the ASCOP electromechanical division. The renamed division manufactures time division multiplexing switches for commercial and military use.

The new name was chosen to reflect a broadening of the company's products through a planned program of growth, particularly in the development of electromechanical components for data and control equipment.

A-C Plans Big Laboratory

Allis-Chalmers Manufacturing Co. is planning a new 23,000-sq ft laboratory building for engineering

development and research in the Milwaukee area.

The initial building, a one-story affair, will be used for scientific studies and analyses, and for the design, construction and testing of models, mockups and prototypes of nuclear reactors and associated equipment.

A staff of 150 to 200 engineers, scientists, draftsmen, technicians and administrative personnel will be housed in the facility which will employ modern electronic calculating equipment.

Robertson Heads New Department

THE GOVERNMENT and industrial division of The Magnavox Co., Fort Wayne, Ind., sets up an advanced development engineering department with G. D. Robertson (picture) as its manager.

This department under Robertson's direction, has been formed to facilitate development and exploitation of recent scientific and technological advances. It will conduct exploratory work on industrial and defense problems.

Robertson will be in charge of all experimental and theoretical studies of advanced systems, techniques, and components to be used in communications, navigation, radar, undersea warfare, data processing and guided missiles.

Since joining Magnavox in 1953, he has served as staff engineer, chief

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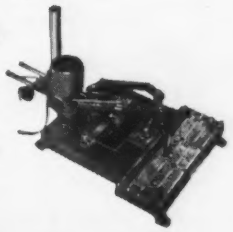

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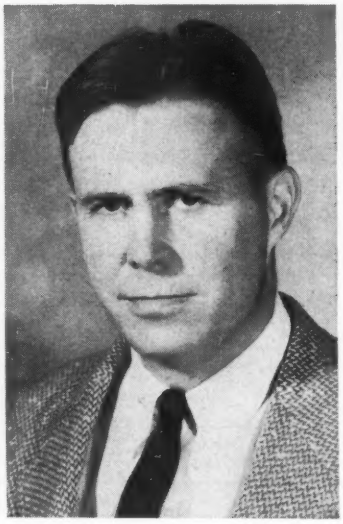
sonar engineer and section chief of communications and navigation. During this time, he supervised research, development and production engineering on communication and navigation transmitters and receivers and antisubmarine warfare systems.



RFL Has New Director

EVERETT A. Gilbert (picture) is elected a director in addition to his duties as vice-president in charge of engineering at Radio Frequency Laboratories, Inc., Boonton, N. J. He has been in charge of engineering at RFL for nine years, eight of them as v-p.

At the same meeting Roger S. Kingsland was elected v-p in charge of purchasing; Harry Parliment, v-p in charge of production, and Henry E. Emker, v-p in charge of marketing, communications products division.

Hoffman Reorganizes

IN A MOVE designed to streamline its operations and better identify its activities, Hoffman Electronics Corp., Los Angeles, Calif., has effected an internal reorganization.

Under the new setup, Hoffman Laboratories, Inc., which was previously a wholly-owned subsidiary, has been made the Hoffman Laboratories Division of Hoffman Electronics. Hoffman Laboratories is engaged in research, development and production of electronic equipment and systems for the military, including the fields of radar, communications, navigation, countermeasures, sonar, fire control and missile guidance.

Name of the Hoffman Radio Division has been changed to the Consumer Products Division of Hoffman Electronics. The Hoffman Semiconductor Division in Evanston, Ill., is now called the semiconductor division of Hoffman Electronics Corp.

Du Mont Ups Carlin, Scott

ORGANIZATION changes in television tube operations at Allen B. Du Mont Laboratories, Inc., Clifton, N. J., result in the promotion of two key men.

William Carlin is named manager of the television tube division and will be in charge of all tv tube manufacturing. Robert G. Scott, general sales manager for tv tubes, receiving tubes and Du Mont replacement parts, will now report directly to S. J. Koch, vice president and general manager, tube operations, and will have broad responsibility for product planning, marketing, and operating profit.

Carlin has been associated with the television tube division since he joined the company in 1948. He has been a manufacturing supervisor, assistant manufacturing manager, manufacturing manager, and manager of equipment engineering for tv and industrial tubes. Before joining Du Mont he was associated with the National Union Radio Corp.

Scott joined the Du Mont company in 1948 as a senior engineer in the cathode-ray tube engineering department. He was next made head of commercial engineering, and in 1952 was named sales engineering manager. He became successively assistant sales manager and then general sales manager for

tv tubes. Prior to joining Du Mont, Scott was an engineer with National Union Radio Corp.

IT&T Executive Moves Up

DIRECTOR of research and engineering for International Telephone and Telegraph Corp., Frederick R. Furth (picture) has been elected a vice president of the corporation.

Furth joined Farnsworth Electronics Division of IT&T as special assistant to the president in 1955, following his retirement as U.S.N. admiral. He became vice president of Farnsworth and in March, 1957, was appointed deputy director of research and development for IT&T, with headquarters in New York. He became director last July.

As chief of naval research in 1954 and 1955 Furth directed the expansion and use of new techniques in research of the upper atmosphere, permitting the Navy to move ahead rapidly with the technical portion of the earth-satellite program.

IRE Appoints Officers

AT ITS January meeting the IRE board of directors appointed six members to the board for 1958.

Reappointed as treasurer is W. R. G. Baker, vice president

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for research of Syracuse University, Syracuse, N. Y. Haraden Pratt is appointed to his sixteenth term as secretary. John D. Ryder, dean of engineering, Michigan State University, East Lansing, Mich., becomes editor of the *IRE Proceedings*, succeeding Donald G. Fink, director of research of the Philco Corp.

Appointed as directors are Alfred N. Goldsmith, consulting engineer and editor emeritus of the *IRE Proceedings*; D. B. Sinclair, vice president of engineering, General Radio Corp., Cambridge, Mass.; and Ernst Weber, president of the Polytechnic Institute of Brooklyn and president of Polytechnic Research and Development Co., Brooklyn, N. Y.

Executive Moves

John S. Leigh moves up from assistant chief engineer to chief engineer of National Aeronautical Corp., Fort Washington, Pa.

J. Z. Millar, assistant vice-president, development and research, at Western Union Telegraph Co., New York, N. Y., is designated to head sales of the company's technical services and equipment, in addition to his present duties.

Plant Briefs

FORMERLY located at Flushing, N. Y., the administrative and general offices of **Sterling Precision Corp. Instrument Division** are now settling in their Port Washington, N. Y., plant. Main plant remains in Flushing.

In a move to centrally locate manufacturing facilities in prime market areas, William Brand & Co., Inc., Willimantic, Conn., has organized a new subsidiary corporation, **William Brand Wire and Cable Corp.,** in Santa Monica, Calif.

Taylor-Leslie Mining & Engineering Corp. Ltd., Toronto, Ontario, Canada, is preparing a facility for the manufacture of silicon transistors, diodes, rectifiers and photo transistors. The firm has been licensed by Western Electric to utilize all the Bell Labs patents applicable to semiconductors.

Sperry Phoenix Co. has purchased 3,400 acres 2½ miles northeast of Beardsley, near Phoenix, Ariz., as site of a future plant.

News of Reps

Martin P. Andrews, Inc., now handles the precision component line of Electro-Tec Corp. in all of New York State except Westchester, Putnam, Orange and Rockland counties. **R. S. Pettigrew & Co.** will merchandise the same line in the New England territory.

Hicksville, N. Y. reps, **Hunter & Salsbury Inc.,** take on the line of precision snap-action switches of Unimax Switch, division of the W. L. Maxson Corp. They will sell in the metropolitan New York-New Jersey area to accounts engaged in government contract work.

Automatic Switch Co. of Florham Park, N. J., announces change of address of their representative, **J. R. Ruddock & Associates,** from Irving Park Road to 4822 N. Damen Ave., Chicago, Ill.

Radio Receptor Co., Inc., selects **Donert Associates,** as sales representative to radio, tv and phonograph original equipment manufacturers for its selenium rectifiers and germanium and silicon diodes in the New York metropolitan area.

Scientific-Atlanta, Inc., has new reps in California and Illinois. Antenna pattern recorders, digital X-Y plotters, microwave receivers and plastic fabrications are handled in Chicago by the **Pivan Engineering Co.** Reps in California are the **J. T. Hill Co.,** with offices in San Gabriel, San Carlos and San Diego.

Jackson Edwards Co., Los Angeles electronic reps, have occupied their new building at 4101 Lankershim Blvd., North Hollywood, Calif.

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